REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

UNIVERSITY OF MICHIGAN
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MAIN READING ROOM

HEARINGS

BEFORE THE

SUBCOMMITTEE ON LEGISLATION

OF THE

JOINT COMMITTEE ON ATOMIC ENERGY

CONGRESS OF THE UNITED STATES

EIGHTY-FIFTH CONGRESS

SECOND SESSION

ON

REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

MARCH 12, 14, 22, AND MAY 23, 1958

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REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

WEDNESDAY, MARCH 12, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to notice, at 10 a. m., in room 457, Senate Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Holifield, Price, and Hosmer; Senators Pastore and Hickenlooper.

Also present: James T. Ramey, executive director; and David R. Toll, staff counsel, Joint Committee on Atomic Energy.

Representative HOLIFIELD. The subcommittee will come to order.

The Chair will make a very sad announcement before we start our hearings this morning. We have lost one of the members of our Joint Committee, Congressman Dempsey, who passed away yesterday.

Of course, it is a matter of great sorrow, and all the members of the committee feel that they have lost a very valuable member of our committee, and a highly respected and honorable Member of Congress.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning in public session in order to receive testimony on the proposed arrangement No. 58–111–4 between the Atomic Energy Commission and Nuclear Development Corporation of White Plains, N. Y.

Under section 111b of Public Law 85–162 (AEC authorization act for the current fiscal year 1958), the committee is required before it enters into any proposed arrangement or amendment thereto under the power reactor demonstration program, to submit the basis of each such proposed arrangement to the Joint Committee for a period of 45 days.

The Atomic Energy Commission currently has a contract with the Nuclear Development of America to perform initial research and development work on a sodium cooled, heavy water, pressure-tube-type reactor.

This reactor, when determined to be feasible, is proposed to be constructed in cooperation with the Chugach Electric Association, near Chugach, Alaska.

By letter dated February 7, 1958, the Commission advised the Joint Committee that it proposed to extend the existing contract to provide for further research and development and for preliminary design on the proposed reactor.

The February 7, 1958, letter forwarded the program justification data describing the basis of the proposed contract extension.

At this point, without objection, I would like to insert in the record the AEC letter dated February 7, 1958, and the program justification data forwarded by that letter.

(The information referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., February 7, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: Under contract No. AR (30-3)-256, the Nuclear Development Corporation of America is currently performing on a cost-plus-fixed-fee basis initial research and development work directed to the Chugach Electric Association demonstration reactor. This work is directed primarily to a determination of the basic feasibility of insuring the separation of heavy water and sodium. It is anticipated that sufficient information will have been developed by June 30, 1958, to enable the Commission to make a determination whether or not definitive development work should be undertaken.

If the determination is to proceed, the Commission proposes to extend the existing contract; to provide for the necessary definitive research and development and for preliminary design.

In accordance with section 111 (b) of Public Law 85-162, there is submitted, attached, program justification data describing the basis of the proposed contract extension.

In the event definitive research and development work is undertaken, the Commission plans to defer negotiation of contracts covering reactor construction and operation for approximately 2 additional years, at which time the preconstruction research and development program will be substantially completed.

House Report 978, the joint committee report to accompany H. R. 8906, indicated the construction cost of the Chugach reactor to be $6,729,000. The following subsequent developments have led us to change this figure to $9,229,000.

"(*a*) Whereas it was originally believed that a remote location might be available for the reactor, it is now apparent that Chugach can provide only its existing plant area located near a populated district, and utilize existing generating equipment. In view of this consideration, it has been concluded by NDA and the Commission that a special containment structure should be included in the project plans. In response to an AEC request, NDA has indicated that its previous quotation would need to be increased by $1,500,000 for the containment structure and $500,000 for remote control instrumention for the contained portions of the reactor complex.

"(*b*) The original NDA quotation was made subject to escalation based on rising costs. In the intervening period it is estimated that the increase will have amounted to about $500,000."

If the Commission defers, until the end of the preconstruction research and development period, negotiations for reactor construction, NDA has expressed willingness to construct at the figure of $9,229,000, subject to escalation based on a standard index.

Sincerely yours,

LEWIS STRAUSS, *Chairman.*

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58-111-4

A. *Name of contractor*

Nuclear Development Corporation of America, White Plains, N. Y.

B. *Description of proposed project*

1. *Objective.*—The objective of the proposed contract extension is to encourage private participation in the development of nuclear power technology and to accelerate the achievement of commercially feasible nuclear power. Under the contract extention definitive research and development and preliminary design will be performed, directed to a sodium-cooled, heavy water, pressure tube demonstration power reactor.

2. *Location.*—The Knik Arm plant site of the Chugach Electric Association, Anchorage, Alaska.

3. *Technical aspects (data are approximate).*—
Reactor heat output: 40,000 kilowatts.
Electrical output: 10,000 kilowatts.
Amount of fuel loading: 10,000 kilograms.
Enrichment percent U-235: 2 percent.
Moderator: Heavy water.
Coolant: Liquid sodium.
Reactor outlet temperature: 950° F.
Reactor pressure: atmospheric.
Steam conditions: 850 p. s. i. a., 850° F.
Byproduct utilization: None presently contemplated.

4. *Estimated date of completion.*—For definitive preconstruction research and development, June 1960.

C. *Estimate of cost*

Initial research and development under present AEC contracts	1,725,000
2. Work performed in AEC facilities	850,000
Total	8,155,000

The above excludes:

Initial research and development under present AEC contracts	$1,725,000
Initial research and development NDA contribution	25,000

NOTE.—House Report No. 978 indicates $2,225,000 as the cost of initial research and development, including $500,000 in AEC facilities, and $500,000 for preliminary design. The plans for the research and development program have been revised to undertake work in AEC facilities and preliminary design in the second phase to be covered by contract extension. In addition, it has been found necessary to include in the initial research and development program, at an estimated cost of $500,000, certain experimental work originally planned for the second phase. Thus the total estimated cost of the initial research and development is $1,725,000.

D. *General features of proposed arrangements*

1. *Term.*—The term of the contract extension will continue until completion of definitive preconstruction research and development, estimated by June 1960.

2. *Type of contract.*—The contract will be on a cost-plus-fixed-fee basis.

3. *Indemnity.*—The Commission will indemnify the contractor for loss or damages arising from nuclear incidents in a manner consistent with Public Law 256, 85th Congress.

4. *Termination.*—The contract may be terminated at any time by the Commission without penalty.

5. *Patents.*—Whenever any invention or discovery is made or conceived by NDA or its employees in the course of, in connection with, or under the terms of this contract, NDA shall furnish the Commission with complete information thereon; and the Commission shall have the sole power to determine whether or not and where a patent application shall be filed, and to determine the disposition of the title to and rights under any application or patent that may result; provided, however, that if the Commission determines not to file, NDA may file any United States patent application subject to Commission security requirements and regulations, and may, subject to Commission approval, file any foreign patent application.

6. *Informatoin and records.*—NDA will keep records of technical, economic and financial data developed in connection with the project and supply that information to the Commission for its use and dissemination. The Commission and its representatives will have the right to inspect and audit the work, records, reports, information, data and activities of NDA under the project. The contract will also include the statutory GAO audit provision.

Representative HOLIFIELD. Mr. Davis, Director of the Reactor Development Division, is here this morning and Mr. A. Tammaro, assistant general manager for research and industrial development.

Mr. Davis, what is the order of your presentation?

STATEMENT OF W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT, ATOMIC ENERGY COMMISSION

Mr. DAVIS. I should like to make a brief statement on the project.

Then I thought we could discuss the data sheet as it was submitted.

Representative HOLIFIELD. You may proceed.

Mr. DAVIS. It is a pleasure to be here today to discuss with your committee our proposed cooperative arrangement with the Nuclear Development Corporation of America for the reactor proposed for construction at Chugach, Alaska, under the "second round" of the Commission's power demonstration program.

The other Commission staff with me today will, I believe, be able to answer any questions you may have on the conclusion of this brief introductory statement.

On February 7, 1958, in a letter to the chairman we submitted program justification data covering the proposed cooperative arrangement for the Chugach reactor in accordance with section 111 (b) of Public Law 5–162.

This proposed arrangement, you will note, constitutes somewhat of a departure from arrangements referred to you last September covering the reactors for Consumers Public Power District and Northern States Power Co.

Each of the previous arrangements covered an entire project through the completion of construction and a 5-year operating period.

In the present case there are still uncertainties regarding the technical and economic feasibility of the sodium cooled, heavy water moderated reactor.

As indicated in our February 7 letter, before June 30, 1958, we expect to make a determination of the basic feasibility insuring the separation of sodium from heavy water in this reactor.

Subject to a positive determination in this case, we propose extending the current cost-plus-fixed-fee contract with NDA for a 2-year period of preliminary design and continued research and development.

Contingent upon the successful outcome of that 2-year phase, we would then propose to negotiate a contract with NDA and with Chugach Electric Association covering the construction and operating phases of the project, respectively.

The proposed course of action has the concurrence of the Chugach Electric Association as well as NDA.

In addition, as indicated in our February 7 letter, NDA has confirmed by its letter to us of December 2, 1957, its willingness to hold open for the additional 2-year period its offer to construct the reactor at the present ceiling price subject to escalation based on a standard index with appropriate adjustments for additional features such as containment and remote-control instrumentation which it now appears will be required at the time of construction.

Mr. Delmar Morris, Assistant Director for administration, of the Division of Reactor Development, has been the principal negotiator for the arrangements now before you.

I believe he will be able to answer any detailed questions you may have with respect to the negotiations and we will try to answer any technical questions you may have on the reactor itself, as well.

Mr. RAMEY. May we have the letter of December 2 that you refer to?

Mr. DAVIS. I would be glad to read this into the record if you would like to have me do that.

Representative HOLIFIELD. Please read it.

Mr. DAVIS. The letter of February 7, 1958, addressed to Chairman Durham——

Representative HOLIFIELD. No, the letter from the NDA to the Commission. You may just furnish it to us, please. It will not be necessary to read it.

(The following letter was forwarded by the AEC for the record:)

NUCLEAR DEVELOPMENT CORPORATION OF AMERICA,
White Plains, N. Y., December 2, 1957.

ATOMIC ENERGY COMMISSION, DIVISION OF REACTOR DEVELOPMENT,
Washington, D. C.

(Attention Mr. Delmar Morris.)

GENTLEMEN: This is in response to the questions developed during the course of our discussion with your negotiating committee on November 19 concerning the sodium deuterium reactor project.

Both the discussion and the questions revolved around the difficulty of ascertaining with accuracy at this stage of development what will be appropriate terms and conditions for this project at later stages. The original proposal submitted by NDA and Chugach in January 1956 took account of this difficulty by giving all parties to the project equal, unlimited right of withdrawal at certain prearranged decision points. The project has subsequently been rephased to meet the desires of the Commission, and NDA has been asked, in effect, to define more limited withdrawal rights at new decision points.

Our discussion on November 19 also took cognizance of the deferral of preliminary design effort from phase 1 to phase 2. This deferral of preliminary design effort has had the effect of preventing the preparation of more adequate cost estimates at this time, especially with regard to phase 3A (construction).

While NDA desires to respond effectively to the questions raised, it is essential that we restate our willingness, without equivocation, to proceed on the basis of the original proposal, should that now be desired.

The questions raised on November 19 and NDA responses follow:

1. Containment: In line with NDA letter of July 4, 1957, what ceiling does NDA propose be placed on Commission contribution to a containment building if one is required?

Response: NDA proposes that the Commission assist in meeting the cost of any required containment to a maximum of $1,500,000 for the structure itself, and $500,000 for additional remote control instrumentation for the contained portions of the reactor complex, if limited or no access during operation is required.

Explanation: NDA has estimated the type and size of containment structure for two cases—one assuming most of the coolant and moderator materials are in a single structure, and another assuming the minimum portion of such materials is in the primary containment structure. NDA has also examined present trends in containment philosophy, especially that related to totally remote control of the contained portions of reactor plants. Since the entire decision concerning the type, size, and nature of operation of the contained system lies with Government regulatory bodies and beyond the control of NDA, the proposed cost ceilings for Commission contribution are selected to assure probable acceptable facilities of this nature at no cost to NDA. These cost ceilings might be reduced if the Commission is now prepared to define containment standards in sufficient detail and give contractual assurance that NDA will not be held to more severe and more costly standards at some later date.

2. Reestimate of phase 2 costs: In view of the reprograming of phase 1 and subsequent delays in geeting the design and development aspects of this project underway, reestimate the cost of phase 2. Assume relaxation of the requirement to use metallic fuel elements.

Response: NDA requests an increase in phase 2 Commission obligation from $7,750,000 to $8,250,000 and no increase in Commission facilities assistance. We should also discuss the increased cost of phase 2 introduced by a 1-year lag consumed in negotiations.

Explanation: Phase 2 was estimated during the selection board hearings in May 1956 at $7,750,000 plus $800,000 of assistance in Commission facilities, less any portion of such assistance used in phase 1. An arbitrary amount of $445,000 within the $7,750,000 was designated as a capitalizable design cost.

Approximately $500,000 of design effort originally scheduled for phase 1 was deferred by reprograming and adding new experimental work scope. This deferred design effort was necessary to permit an improved cost estimate at the end of phase 1. You will recall that NDA originally requested an absolute withdrawal right at the end of phase 1, contingent only upon the contribution by NDA of an additional $100,000 to phase 1 work.

NDA now finds itself requested to reestimate phase 2 without significantly improved design data. It is also necessary to accept the fact that the design effort and much of the development work will be done about 1 year behind the original schedule, hence at further inflated costs.

NDA now requests, therefore, that the $500,000 of preliminary design effort not performed during phase 1 be added to phase 2. This amounts to a new phase 2 total for Commission costs of $8,250,000, but it does not change the basic assumptions underlying the original estimate. NDA would like also to discuss with you the impact of increased labor costs in prospect because of the 1-year negotiating lag. The increased labor cost observed at NDA during this period has amounted to about 8 percent.

NDA also notes that essentialy none of the $800,000 of assistance in Commission facilities has been utilized in phase 1 and requests that all of the balance be available in phase 2. No new request for assistance in Commission facilities is introduced. However, it has been suggested that the extensive Du Pont program of criticals might include one directed to the SDR program. Recent experiences raise the possibility that such a critical conducted earlier in the program than at a startup might be quite valuable.

3. Division of phase 2: In view of the need for having phase 2 and phase 3 run in part concurrently, estimate the amount of expenditures needed in phase 2 prior to commencement of phase 3 and after commencement of phase 3.

Response: In order not to confuse old and new dollar amounts, this response is being made in percentages. NDA estimates that all of the anticipated expendable materials and equipment, in amount of $1,340,000, and 75 percent of the remaining phase 2 costs would be incurred prior to a decision concerning commencement of phase 3. Approximately 25 percent of phase 2 costs would be incurred after the commencement of phase 3.

Explanation: This division involves two problems. First, some costs of phase 3 should be incurred in the months immediately preceding decision concerning commencement of phase 3 in order to permit orderly prosecution of the project. These would carry cancellation charges if the decision were not to begin phase 3. The accounting for the liability of cancellation charges has not been discussed with the Commission. Second, the phase 3 decision might be expedited to an earlier point in phase 2 if the decision to proceed with phase 2 is made in April 1958 instead of July 1958. (See question No. 5.)

On balance, the estimate of division given tends to assume no heavy cancellation costs, no expediting of the phase 3 decision, and authorization of some small amount, perhaps $150,000, for phase 2 efforts in the last 2 or 3 months of phase 1.

4. Rephasing of the project: If some significant portion of phase 2 costs will be incurred after commencement of phase 3, and if the ability to predict the conclusion on such items as containment is inadequate for reasonable adherence to the original project phasing and terms, suggest a feasible alternate course.

Response: This question was explored and answered during the November 19 discussion. An alternate was outlined. This has been reexamined and found acceptable. It consists of continuing all research and development under extensions of the present CPFF contract for phase 1. Construction and experimental operation would then be performed under a CPFF contract with a ceiling as originally projected.

Explanation: In this alternate approach, the Commission would gain the complete direct control of the research and development programs of phase 2 and seems highly unlikely to incur any costs greater than those originally contemplated under the CPFF contract with a ceiling. In fact, some of the suggested additions to phase 2 costs set forth in the response to question No. 2 might prove unnecessary since these are more in the nature of conceivable contingencies than known costs.

NDA, on the other hand, would have to yield program control which is the concomitant of a closed end cost for the Commission, and would in turn be

released from liability for any overrun in phase 2. This latter liability is, in fact, not substantial provided NDA retains its right, requested in the original proposal, nor to proceed with phase 3 if the SDR does not have sufficient technical promise.

(For further points bearing on these matters, see the response to question No. 5 below.)

5. Decision criteria: What are the specific criteria NDA believes should form the basis for decision as to proceeding with phase 2 and phase 3?

Response: NDA believes that the criteria for proceeding with phase 2 and with phase 3 should be the same for NDA as for the Commission. They are as follows:

Phase 2:

(*a*) The SDR concept continues to have technical promise.

(*b*) There are possible successful barrier materials and barrier configurations.

(*c*) There is reason to believe that such reactions as may occur in the reactor will not be autocatalytic.

Phase 3:

(*a*) There is a reasonable prospect of obtaining all necessary construction and operation approvals.

(*b*) The concept holds promise of being acceptable for future applications.

(*c*) There is reason to believe that SDR-type reactors can be economically competitive (e. g., exorbitantly costly containment will not always be required).

(*d*) There are no unsolved development problems in significant components and known sources of supply able to deliver to acceptable specifications have been identified; significant components include fuel elements, pumps, valves, heat exchangers, control-rod drives, leak-detection systems, steam generator, and barrier materials.

(*e*) The cost components over which neither NDA nor the operating utility have control are in prospect of permitting reasonable operation during the experimental operating period; these include fuel materials, special nuclear materials buy-back prices, and chemical reprocessing.

6. Escalation of construction costs (phase 3A): What definition of escalation on phase 3A (construction) costs does NDA propose and what limits on escalation are acceptable to NDA?

Response: NDA made its estimate in January 1956 and requested escalation. NDA would be prepared to accept escalation on all components produced in the United States measured by the Bureau of Labor Statistics domestic United States industrial labor index and on all costs of construction and erection in Alaska by the Bureau of Labor Statistics labor index for the Territory of Alaska. NDA is not in a position to absorb any of the increased phase 3A costs resulting from inflation in the cost of doing business, but is prepared to accept an escalation ceiling limited to NDA's scheduled completion date.

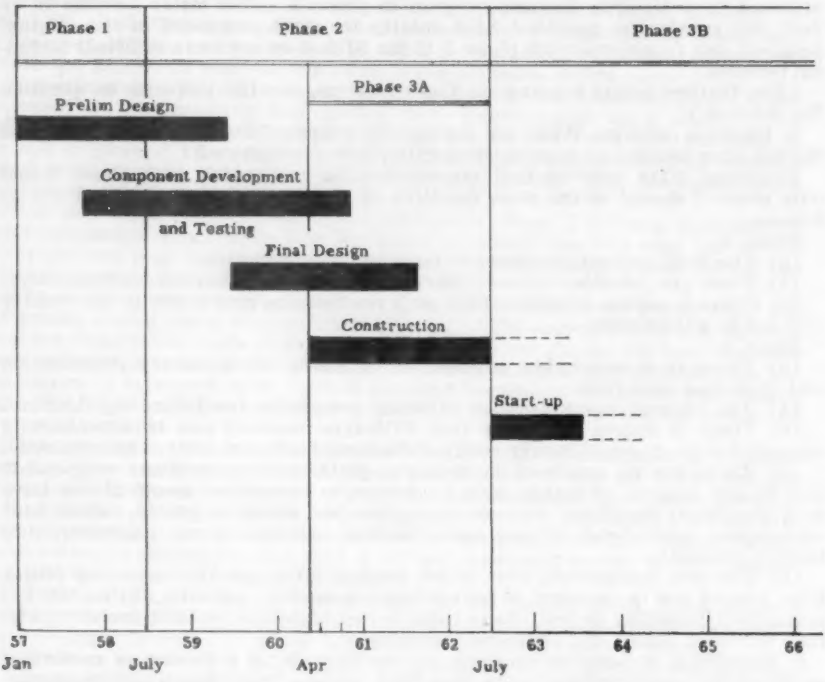
7. Project schedule: Redraw the schedule shown following page 49 in the NDA section of the original proposal.

Response: See enclosed schedule.

We trust that this is responsive to your present needs.

Sincerely yours,

WALTER A. HAMILTON,
Manager, Contract Operations.



Representative HOLIFIELD. Did you say Mr. Morris will proceed now?

Mr. DAVIS. Yes.

Representative HOLIFIELD. All right, Mr. Morris.

STATEMENT OF D. M. MORRIS, ASSISTANT DIRECTOR, DIVISION OF REACTOR DEVELOPMENT

Mr. MORRIS. The contract which we propose to modify and extend is now in existence between the Commission and NDA. It is a rather normal cost-plus fixed fee research and development contract.

At the present time work is proceeding under this contract in the preliminary phase, which has as its principal objective the establishment of the feasibility of separation of the sodium and heavy water.

That phase of the work is expected to be completed by June 30 of this year.

Subject to favorable findings with regard to the work that is now being conducted, our proposal is to modify and extend this contract to provide for approximately 2 more years of research and development and, as Mr. Davis said, if the result of that additional work is favorable, we will proceed with the contract for the construction and operation phases of the project.

As we have shown in the program justification data sheet, the estimated cost of the first phase which is now under way is $1,750,000, and the cost of the additional research and development and preliminary design work contemplated during the next 2 years is estimated at $8,155,000.

I could proceed with the points in the program justification data, if you like, or answer questions.

Representative HOLIFIELD. Let us put a few answers on the record at this time, then we can go into that. Some of the questions may cover some of the points that are pertinent.

How much money has been spent under the existing contract?

Mr. MORRIS. The expenditures to the end of January were approximately $900,000.

Representative HOLIFIELD. Has that all been laboratory work?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. In the Commission's laboratories, or NDA laboratories?

Mr. MORRIS. NDA laboratories.

Representative HOLIFIELD. Under contract?

Mr. MORRIS. Right.

Representative HOLIFIELD. What has been accomplished to date?

Mr. MORRIS. Several tests have been performed on a laboratory scale to demonstrate the ability to maintain a separation of sodium and heavy water.

If you wish to get into this, perhaps Mr. Davis or the NDA representatives could speak to that more accurately than I could.

Representative HOLIFIELD. Without going into detail, do you feel that there has been appreciable advancement or accomplishment in the expenditure of that fund?

Mr. DAVIS. Maybe I had better say a few words on that, Mr. Holifield, and then perhaps you will want to get an expression from Mr. Menke.

But the first phase of this contract was specifically directed toward trying to obtain some kind of demonstration that we could successfully prevent the sodium and the water from getting together with a high degree of assurance.

And the work of NDA has been directed towards exploring this and to setting up some experimental facilities to try to demonstrate this on a modest but sufficient scale in order to give us that assurance.

It has not included very much work on the more advanced phases of the development which would come in phase 2.

Some of these experimental facilities are just about getting into operation now and will furnish the information that we hope to have by June 30.

I was up at NDA a few weeks ago and saw some of these just about at the stage when they were about to go into operation.

Representative HOLIFIELD. Are these facilities in the nature of original type facilities, or are they duplicates of facilities which we have in our national laboratories?

Mr. DAVIS. These are unique to this particular problem.

Representative HOLIFIELD. They are unique?

Mr. DAVIS. Yes, sir.

I just wanted to say before perhaps referring any questions to Mr. Menke, that so far from anything I have ever heard, this still looks like it is quite a feasible thing. This is what we do have to get pretty good assurance on by June and the task for NDA is to give us assurance by this time.

The next few months will be the critical months in determining whether or not we have it.

Representative HOLIFIELD. One of the real problems is the danger of the mixture of heavy water and sodium, is it not?

Mr. DAVIS. This is the key point, to find some way of making sure that when you have sodium in a tube going through a tank of heavy water that there is no possibility of these two getting together.

There are also possibilities of reducing the hazard if this should happen.

Representative HOLIFIELD. What would happen in the event such a mixture would occur?

Mr. DAVIS. This would depend to some extent on precisely how it happened. The most likely thing would be for the sodium to go into the water which, of course, then leads to a chemical reaction and the evolution of some heat.

If also gives rise to the formation of hydrogen which, if ignited in some way, can lead to an explosive hazard.

Representative HOLIFIELD. I notice in the letter of February 7, that there is a discussion about the location of this plant and there was a discussion that Chugach can provide only the existing plant area located near a populated district in order to utilize its existing generating equipment.

Does this mean that you have had to increase your cost of containment and your other precautionary methods because of its closeness to a populated district?

Mr. MORRIS. This is not necessarily the case, Mr. Holifield, because we do not know at this time what the containment requirements would be even if we moved the site out to a more remote area.

The probabilities are that the containment requirement would be less severe and less costly if a remote site could be picked.

I will attempt to explain why the remote site has been eliminated from our consideration. In discussions with the representatives of the Chugach Electric Association, NDA and the Rural Electrification Administration, it became apparent to us that the Chugach Electric Association could not meet the rather stringent requirements of the REA if they attempted to provide the conventional facilities, that is, the turbine generator, at a remote site.

This is due to the fact that in order to obtain the funds from REA for the conventional portion of the plant, it would be necessary for them to demonstrate conclusively that such a plant if converted to a complete conventional plant, that is, with a boiler substituted, would provide Chugach with the best, most economical source of power that they could obtain.

This apparently would not be the case in view of the existing plant which is right in Anchorage.

So as a practical matter, it was concluded that they could not make the necessary finding of feasibility, that is, REA could not make the necessary finding of feasibility. If Chugach attempted to construct these conventional facilities at some site other than their existing site.

Representative HOLIFIELD. Now, under the original contract what was the participation of the Chugach people?

Mr. MORRIS. Under the original proposal the Chugach Electric Association was to provide a site and the conventional facilities, namely the turbine and generator.

Representative HOLIFIELD. At that time had they contemplated using their existing generator plant, or had they not contemplated obtaining through loans with REA, money to construct a plant at another site?

Mr. MORRIS. It was contemplated that they would run the steam from the reactor plant to existing turbine generators during the initial portion of this 5-year period, but that before the end of the 5-year period their load would have grown to the point where they could justify an additional turbine generator.

This would depend to some degree upon the performance of the reactor plant. After it had demonstrated that it was a source of firm power and after their load growth had justified the need for this, they would then install a new turbine generator.

Representative HOLIFIELD. There has been a new plan evolved, then, because, as I remember, the atomic power was to be furnished during the time when the hydroelectric power was unavailable because of the frozen water condition.

As I remember, the atomic plant was to be used in that off season to furnish electricity, was it not?

Mr. MORRIS. We expected that they would operate it in this fashion.

However, I think it has been understood from the beginning of this negotiation that it would perhaps be a year or two after the estimated completion date of the reactor before their load growth would require the installation of new turbine generator facilities.

Representative HOLIFIELD. Now, what effect does the decision on the part of REA have on the overall plan?

Mr. MORRIS. It is not a decision of REA really, but it is clarification of their requirements, their requirements as to the loan that might be required.

This has led all parties concerned to the conclusion that it would therefore be necessary for Chugach to use their existing site and install any new turbine generator at the existing site so that it could be integrated.

The existing site is in the city of Anchorage so that it is near a heavily populated area. This would naturally cause greater concern in considering the need for containment and other safety features.

Representative HOLIFIELD. What has the effect been upon the Federal financial participation?

Mr. MORRIS. We have asked NDA for an estimate of the maximum cost to the Commission if the necessary containment were added to the design of the reactor. It had not been provided for in the initial proposal.

The answer was that if they had to establish a maximum cost figure at this time, prior to completion of their research and development and final design program, the maximum cost quoted would be $1,500,000 for the containment structure and an additional $500,000 for remote instrumentation if that were also required for safety reasons.

Representative HOLIFIELD. This is a result of the clarification of the REA's position on the loan?

Mr. MORRIS. It is influenced by that.

However, we are unable to say that we could eliminate this need for containment by relocating the site to a somewhat more remote area.

Representative HOLIFIELD. What part of that $2 million represents an additional amount over the original contemplation?

Mr. MORRIS. The $1½ million for containment, the $500,000 for remote instrumentation are additions that we would have to provide for if we were to contract now for the construction.

These moneys may not be required, but we would have to provide for them.

Representative HOLIFIELD. This, in effect, then, does reduce the capability of the Chugach people to contribute? It makes it more of a Commission operation than a joint operation?

Mr. MORRIS. No, it would not affect their participation which was only to provide the site and the turbine generator facilities.

It would make the project more costly to the AEC and at the end of the 5-year period, or at such time as we contemplated transferring title and selling the reactor to the Chugach Association, they would be faced with larger charges that certainly affect the feasibility of carrying on the operation.

Representative HOLIFIELD. Would it be cheaper from the Government's point of view to provide assistance to the Chugach Association to construct at the original site rather than providing the $2 million for containment and control at their own site?

Mr. MORRIS. We have not made an analysis which will enable us to answer that precisely.

Representative HOLIFIELD. Why have you not done so? They are asking for money from the Government. It would seem to me this would be just an elementary exercise on your part of asking.

Mr. MORRIS. We are not asking at this time for additional money to provide for this containment. As a matter of fact, because we were faced with the possibility of this, is one of the chief reasons why we are deferring contractual arrangements for construction and operation until we have had an opportunity to carry on more research and development and to further the design of the reactor plant.

Representative HOLIFIELD. This is looking ahead, then, to the likelihood of an additional cost provided you decide on the feasibility of it?

Mr. MORRIS. Yes, sir.

In large part, because of the potential additional cost, we felt it was prudent to defer contracting for the construction and operation, so as to give NDA a chance to come up with more answers as to the design of the plant.

Representative HOLIFIELD. Your existing contract expired on what day?

Mr. MORRIS. June 30, 1958.

Representative HOLIFIELD. It is in the future, then, that it will expire?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. You are asking for a 2-year extension?

Mr. MORRIS. We are asking for authority to extend it for 2 years during which time additional research and development and preliminary design work will be carired on.

Representative HOLIFIELD. Is there any change in the existing contract as to patent rights?

Mr. MORRIS. No, sir; no changes contemplated.

Representative HOLIFIELD. Do you consider that the Government is entitled to the patents? I am referring now to section 5 of the justification data.

Mr. MORRIS. Yes.

Representative HOLIFIELD. Is that provision in section 5 different in any way from what you have had before with NDA?

Mr. MORRIS. I believe it is slightly, Mr. Holifield. We have with us this morning Mr. Roland Anderson, who is patent counsel of the Commission.

Representative HOLIFIELD. When I asked you if there is a proposed change in the existing contract as compared to the new contract, why did you say no?

Mr. MORRIS. We do not plan to change the existing patent provisions. That is the patent provision in the existing contract. We plan to extend the contract without changing that article.

What we have in section 5 is what is in the present contract. I understood you to ask if this was the same article that we have in all other contracts with NDA.

We have had another contract, unrelated to the Chugach project, between AEC and NDA. I believe the wording of that patent provision is somewhat different, although in substance I believe it is the same.

Mr. RAMEY. Is this patent clause similar to most of your patent clauses for research and development work, meaning the provision for NDA to file for foreign patents?

Mr. MORRIS. Could we ask Mr. Roland Anderson to come up and answer this?

STATEMENT OF ROLAND ANDERSON, PATENT COUNSEL, ATOMIC ENERGY COMMISSION

Mr. ANDERSON. I believe it is very similar to clauses that have been included in other contracts in the last year and a half to 2 years. I think in the 202 hearings last year Mr. Mitchell indicated the policy of the Commission was to permit contractors to file both domestic and foreign applications when they so desired. That has been the practice of the Commission for a number of years.

We have had a regulation in our manual that has permitted contractors to file United States applications for a good number of years.

The additions of "and foreign filings" has been included in a number of contracts in accordance with the policy and practice announced to the Joint Committee at the hearings a year ago.

To that extent, it is a difference, in that it permits them to initiate foreign filings if they so desire.

I think it should be pointed out, however, that the initiation of filing in no way affects the Commission's powers and rights to determine the disposition of the rights and titles in the invention, irrespective of who files.

It was to permit contractors and others when they felt it was desirable and the Commission was not filing promptly enough, to file themselves if they so desired and to initially have that authority if they so desired.

Mr. RAMEY. Does the Commission retain the license?

Mr. ANDERSON. This does not determine any rights. If they file we may take all the rights. We may take rights subject to according them a license.

This does not have anything to do with determination of the disposition of title or rights. It merely is an authority to permit them to file in order to protect, if they so desire, not only the Government, but American industry generally. It does not give the individual contractor any more rights if he has this or does not.

I might say that even if this is not in the contract provision, it has been our policy and practice to permit contractors, and in many contracts where it is not in the contract language we have provided procedures with the contractors to provide them with this privilege.

Mr. RAMEY. Under this clause has NDA filed any patents?

Mr. ANDERSON. They have filed, I believe, several applications in the United States and only yesterday AEC initiated filing applications in some eight countries. These must be filed in order to get the convention date by next Wednesday.

Representative PRICE. Who pays the fees when industry files?

Mr. ANDERSON. When the contractor files?

Representative PRICE. Yes.

Mr. ANDERSON. The contractor.

Now, it may be a reimbursable expense if we take the rights.

Representative PRICE. Reimbursable on the part of AEC?

Mr. ANDERSON. AEC.

Representative PRICE. Have there been instances of that nature?

Mr. ANDERSON. No, sir; there has not been, to date. A number of contractors have filed applications. The patents have not yet issued.

As to the determination of rights in most of those, thus far, we have taken the title, taken the rights in the field of atomic energy and in accordance with our policy permitted the contractor to take the rights in so far as the invention is useful for nonatomic energy purposes.

Representative PRICE. There has been said about the failure of the American patents to be filed abroad, if what you have stated is the practice, why has not industry filed patents abroad?

Mr. ANDERSON. I do not know. It is not the question of filing abroad; it is the question of the rights abroad that they are interested in. Some of our contractors unless they can acquire all rights in an invention in a foreign country, do not want to undertake the expense of filing abroad.

I might say that, so far as I know, in every instance where a contractor has indicated a desire to file abroad he has been accorded the privilege to file abroad subject to one thing, namely, security.

So far as I know in the last two years there has been no instance where the contractor has been denied the right to file because of security.

We have in a classified case modified the classified application so as to put it in unclassified form and thereby permit the contractor to file an unclassified case in any country he desired to.

In those instances where the contractor has indicated it to be desirable that applications be filed, but has not wanted to undertake the expense himself, I think it is fair to say the Commission has undertaken the filings at any time the contractor has shown it was worthwhile to file a patent application.

In addition to that, the Commission has filed on its own a number of applications in foreign countries when it has been deemed worthwhile.

Representative PRICE. What benefit accrues to the individual contractor if he files abroad?

Mr. ANDERSON. He at least assures himself he has the privilege of a nonexclusive license and will not be excluded under the policy of our Government in according nonexclusive licenses to any American industrialist.

If the subject matter is patentable abroad and he wants to sell a device over there and it is a device covered by a United States Government owned patent, he will not be excluded by virtue of that patent from operating in that country.

By the same token, if the Commission owns it, neither will any other American industrialist be barred from utilizing the device in such country, since he would also be accorded nonexclusive rights by the United States Government.

Representative HOLIFIELD. Do I understand you to say—if the Commission decides subsequently to avail itself of the rights under the patent filed abroad by the contractor, that they will reimburse to the contractor the cost of filing?

Mr. ANDERSON. It may be.

Representative HOLIFIELD. Upon what basis do you rest that decision, that practice? It would not detract from the contractor in any way, his rights abroad, would it?

Mr. ANDERSON. No, but it may be an expense which we have incurred jointly with him in encouraging him to file abroad for the protection not only of the contractor, but of the Government and American industry generally.

Representative HOLIFIELD. When you reimbursed his cost of filing abroad, would that in any way detract from his control of the patents in foreign nations?

Mr. ANDERSON. It may or may not.

Representative HOLIFIELD. Does this mean that the Commission, then, would take over the ownership of it?

Mr. ANDERSON. That is correct.

Representative HOLIFIELD. Then if royalties are paid by foreign countries on that patent will the Commission get it, or the contractor?

Mr. ANDERSON. The Commission will get any royalties acquired under that patent.

I should say may.

Representative HOLIFIELD. Are there any further questions of Mr. Anderson?

Mr. RAMEY. Has the question of policy on royalties on foreign patents by foreign users been settled?

Mr. ANDERSON. I would say that the Commission has not charged any royalties on any patents, thus far, whether they be domestic or foreign.

Representative HOLIFIELD. Mr. Morris, what is the difference between the word "initial," referring to research and development, and "definitive" in the proposed extension?

Mr. MORRIS. We use this terminology to differentiate. The work during the first phase which ends this coming June has been pretty largely concentrated on this one crucial question that Mr. Davis discussed, establishing the feasibility of insuring separation of sodium and heavy water.

The feeling was that until we could get the necessary assurance that this could be accomplished it would not be worthwhile to proceed with any extensive work regarding other features of the reactor.

Assuming that this question is settled satisfactorily by June 30, then during the next 2 years we would expect that they would conduct development work on various components and systems and proceed with design work.

Representative HOLIFIELD. This is a sharpening up of the research and development toward the basic feasibility problem?

Mr. MORRIS. That is a good way to express it.

Mr. RAMEY. Are there any changes in your arrangements on the research and development phase between those submitted to the committee for consideration during the previous authorization hearings, and your arrangements as proposed at this time, particularly as to whether you have a closed- or open-end arrangement?

Mr. MORRIS. The research and development phase that we are here discussing is not a closed-end arrangement. The Commission may stop the work at any time if the cost is determined to be excessive, but it is set up on a very similar basis to other CPFF research and development contracts that we have and it provides the Commission with essentially the same degree of control over the work that we have in other cost-plus-fixed-fee research and development contracts.

Mr. RAMEY. Was this the arrangement that was contemplated when you submitted this to the committee last year?

Mr. MORRIS. I believe that during the authorization hearings last summer, we indicated that the construction aspect of the job was still expected to be a closed end and that is the case today.

I do not recall whether our testimony last summer indicated that the research and development was to be closed end for AEC or not.

In any case, the existing contract, which covers the initial phase, for an estimated cost of $1,750,000, provides that this is the maximum amount obligated.

Our obligation only goes that far and their obligation goes that far.

Mr. RAMEY. As I recall, the committee in its finding in its initial report for the second round did give some indication that they thought the closed-end arrangement for research and development was not exactly feasible under the demonstration program anyhow.

Mr. MORRIS. In this case, as I say, we do not have a closed-end arrangement for the research and development, but we do have an agreement with NDA that their offer to handle the construction on a closed-end arrangement will still be available to the AEC during this extended research and development period.

Mr. RAMEY. I note you say in the letter of February 7 that if the determination to proceed is arrived at pursuant to July 1, then you will go ahead with this.

Mr. MORRIS. Yes.

Mr. RAMEY. Then there is the provision that you will go into the construction if you determine 2 years later that this is feasible.

Do you construe the intent under the law to be that when you go into the construction phase you will resubmit the basis of that arrangement to the committee under the 45-day period?

Mr. MORRIS. Yes.

Mr. RAMEY. Is it true that you do not have to wait until July 1 to submit it after you have made the determination to proceed on this research and development phase?

Mr. MORRIS. That is right. We are hoping to be in a position to execute a contract as soon as these technical questions are settled so that there will be continuity of the work.

Representative HOLIFIELD. I notice in section D.1 where you comment upon the term of the contract extension. It is rather vague. You say: "Estimated to be June 1960." Is that the date in your contract, or was it purposely left vague for some reason?

Mr. MORRIS. No, sir; the term would be extended from June 30, 1958 to June 30, 1960.

However, with the uncertainties that are associated with any research and development contract, we worded this the way we did to cover the situation that may arise where it could not be accomplished exactly in these 2 years; it might have to run over or it might be done in some lesser time.

Representative HOLIFIELD. Was the estimate of the time of this extension based on the request of the NDA people?

Mr. MORRIS. Based on their recommendations.

Representative HOLIFIELD. This contract is on a cost-plus-fixed-fee basis. Has the amount of the finding fee been revealed in the testimony anywhere?

Mr. MORRIS. No, sir. The amount of the fixed fee in the present contract is, I believe, about $94,000. Percentagewise, it works out to be a little under 6 percent.

Representative HOLIFIELD. Is there any provision in your contract extension as to title of equipment constructed by Government funds?

Mr. MORRIS. Yes, sir; all such title would be in the Government.

Representative HOLIFIELD. With reference to termination, you state:

> The contract may be terminated at any time by the commission without penalty.

That refers to the 30 days' notice, does it not?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. The objective of the proposed contract for extension is to encourage private participation. Since this work is being done completely under Government contract, as in many previous Government contract jobs, and since the title of the equipment will remain in the Government's hands, where do we find justification for the stated objective?

Mr. MORRIS. The participation, the financial participation, of NDA and Chugach really comes in the later stages of this project.

Mr. RAMEY. On the turbine generator?

Mr. MORRIS. I should have added that NDA has borne $25,000 of the initial expense, but the principal participation will be through Chugach's furnishing of the site and the conventional generating facilities and by NDA in taking certain risks with regard to the fabrication and construction of the reactor.

Representative HOLIFIELD. Of course, that is a matter to be decided later when feasibility is established.

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. Are there any further questions?

Does this complete your statement, sir?

Mr. MORRIS. Yes, it does.

Mr. DAVIS. Looking back on the report for last year, I believe it does confirm our recollection that this was a cost-plus-fixed-fee arrangement on research and development as presented last fall.

Representative HOLIFIELD. There are no new fees involved?

Mr. DAVIS. There would be a fee for the phase 2 portion of the contract.

Representative HOLIFIELD. Yes, but it would be on the same basis that your initial fee was based?

Dr. DAVIS. Yes, sir.

Mr. MORRIS. It was originally expected to be closed end. It was expected that all phases of the project would provide a closed-end commitment for the Government.

Representative HOLIFIELD. As I understand it, in view of the fact that the Government is putting up all the money on this, there is some latitude in regard to the closed-end principle, is there not?

Mr. MORRIS. With regard to research and development, yes, we are carrying out the research and development on the Piqua project, which is also a second-round project on a cost-plus-fixed-fee basis, expecting that the final design and fabrication and construction will still be on a closed-end basis.

Mr. RANEY. Is there any difference in your management arrangements where the Commission has an open-ended arrangement and would assume more responsibility for the direction of the research and development work as against a closed-end arrangement where it would be expected the contractor, unless he is taking a risk there, would assume that responsibility?

Mr. MORRIS. If the arrangement was closed end, the contractor would expect more of a unilateral right to decide the course of the work than he would under the arrangement we have described here.

The arrangement we have described here gives AEC essentially the same right to approve and determine the course of the work that we have in any cost-plus-fixed-fee research and development contract.

Representative HOLIFIELD. Thank you, gentlemen.

I see that we have representatives of NDA in the room.

Mr. Menke and Mr. Zuckert, the representatives of the Chugach people.

At this time would either of you gentlemen like to make a statement in regard to the progress of the research and development which has not been covered, or in regard to the change of site problem?

STATEMENT OF JOHN R. MENKE, PRESIDENT, NUCLEAR DEVELOPMENT CORPORATION OF AMERICA; ACCOMPANIED BY EUGENE ZUCKERT, THEODORE MILLER, AND WALTER A. HAMILTON

Mr. MENKE. Mr. Holifield, I have no formal statement to make.

I might amplify a little bit on the proceedings heretofore.

First, to the progress of the research and development so far. It has been an optimistic affair. We have completed one of three main tasks in research and development to prove that we can separate sodium and water.

That first task has been rather more successful than we might have hoped.

The second task is on stream right now, and the third task, which is a mockup of a portion of the reactor itself, has just been delivered to the site to be erected, and to be tested.

Only on the successful completion of these three tasks will either the Commission or NDA recommend that we go forward with the next phase.

I am very optimistic that the result will be positive and that we will recommend that it should go forward.

The type of reactor which this project is attempting to put into our arsenal of reactors, our catalog of reactors, is one which the Commission and NDA and significant other people think is important, the area of reactors which are moderated with heavy water, which have a capability of burning natural uranium and which can reach high temperature.

Sodium cooling is not the only way to reach high temperature, but it is one of the good ways.

If we fail with sodium, we will try very hard to go forward with another coolant.

So much for your request to reflect on the progress of the work.

On the question of the reactor site, the two possibilities for site at Chugach I have, of course, with me, Mr. Miller and Mr. Zuckert, both representing the Chugach Electric Association.

I might remark briefly on one question which you asked. You asked a very reasonable businesslike question: What is the alternate cost to go to the alternate site?

The reason the decision is difficult is because the capital cost is almost the same to rebuild the turbines and generators, the office equipment and all the services at a new site, that it almost exactly balances the cost of containment and extra instrumentation at the present plant site. I do not wish to imply that no containment at all would be required at the alternate site.

But the operating cost would surely be higher at the new site because essential elements of personnel would have to be duplicated whereas the personnel to operate the turbine and generator at the existing site have to be there anyhow. Whether the steam comes from the present oil-fired boilers or from the nuclear boiler, they are there anyhow.

There are very few men in any powerplant, as you know, to operate a great many turbines.

If we were to move to a separate site to gain the advantage of lesser containment, then we would have to duplicate that staff and the operating cost would go up substantially.

That, at this stage, is the most complete answer I could give to the question you asked.

Our present indications are that it is worth while to build a containment building at the site in Anchorage. I might amplify a little bit more about the site in Anchorage.

I have been to Anchorage and I find it an unusually pleasant city and not nearly so frontier as many of us thought before we got there. It has one peculiarity. There is a river running through the middle of it with a very wide bed. It is called Knik Arm. It is also called Ship Creek. In that bed there are no residences. There is a powerplant, a railroad yard, and numerous industrial warehouses. It is rather wide. It is about a half mile wide and several miles long.

We would put the nuclear plant adjacent to the powerplant in this riverbed. The river has long since become much smaller than when it formed the riverbed. So there is a sort of natural exclusion area in the middle of the city rendering it somewhat more feasible and giving somewhat more remoteness to the location than right in the middle of a city where houses could be built adjacent to it.

Representative HOLIFIELD. Has the Reactor Safeguards Committee inspected the site?

Mr. MENKE. No, the Reactor Safeguards Committee has been invited to our first presentation to the Commission, and were present. And the Commission sent a visitor to Anchorage to make an initial investigation, but that is very informal and by no means a formal Safeguard Committee investigation of the site. That has not occurred yet.

Representative HOLIFIELD. I am somewhat concerned about the informality of these selections of sites. When I was in Great Britain last fall I talked with the people there and talked with some of the people of the Scandinavian countries. Site selection is basic to the whole program. They take very seriously the location of the site.

The first thing that is done is to obtain the approval of site selection. But in our whole set up here we allow the industry to pick the site and make plans and probably purchase land and that sort of thing, make financial commitments in regard to the site, then we call in the Advisory Committee on Reactor Safeguards and ask them, "Is this all right?"

It seems to me it is getting the cart before the horse. I am not just referring to the Anchorage site, but to all site selections.

It seems to me that the people who are interested in actually acquiring a site should, after they have determined the type of reactor, get approval of the site first before going any further.

I am somewhat concerned about the informal way of proceeding to get site approval.

Mr. MENKE. I think I would share your feeling that it would be well to have site approval at the beginning. There is no denying that.

Representative HOLIFIELD. Once financial commitments have been made, land has been acquired, and areas selected, which may be the most economic from the standpoint of the operator of the plant, we come into conflict with the public interest of protection against possible hazards.

I have visited Anchorage. I know pretty well what the layout is there geographically. You are in a kind of bowl there in the mountains. I am not clear in my own mind exactly where the present generator site is located.

Do the Chugach people have anything to say?

Mr. Zuckert, do you have anything to say in regard to this factor of site?

Mr. ZUCKERT. I will have to stick by what Mr. Menke says because he has had an opportunity to go there, which I have not had. It confirms what our people up there have told us, that this is the preferable site from a power economic standpoint, certainly.

The second thing is I should think the subcommittee would like to know that we are still very much interested in getting this reactor as a part of our system.

Going back into the history, this thing started in the fall of 1955 under the second round when we were looking almost 7 years ahead. It was because it was almost 7 years that we were willing to take chances upon an advanced type of reactor which this one was. We had to take those chances because that is the way the second round was set up by the AEC and there was no other way of obtaining a reactor for Chugach in Alaska. We feel reactor construction in Alaska is logical and desirable, and will promote both the art and Alaska.

So that we are still interested in the SDR and we look to this reactor as a part of our system because projection of the system load indicates commensurate growth.

The precaution of course, is that we have to have the time in which to secure conventional facilities in the event that this reactor does not prove to be practical.

Therefore, I think the committee must understand that we are basing our continuing agreement on the assumption, which we have voiced here today, that there is an intention to build this as a power reactor at Chugach should it work out as it now seems it would.

Representative HOLIFIELD. There is no feeling on the part of the NDA people that because the terms of this contract extension is 2 years, that you will not push forward in a most expeditious manner to achieve this goal, is there?

Mr. MENKE. No, sir; it is very much in our interest to push forward beginning right now to get this product delivered.

Representative HOLIFIELD. Thank you, gentlemen.

The committee will take the matter under advisement. We will meet in this room on Friday morning.

Our witnesses will be people representing the Florida and Pennsylvania groups.

The committee is now in recess.

(Subsequent to the hearing, correspondence concerning this project occurred as follows:)

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C., March 26, 1958.

Mr. LEWIS L. STRAUSS,
Chairman, Atomic Energy Commission,
Washington, D. C.

DEAR MR. STRAUSS: The Subcommittee on Legislation of the Joint Committee on Atomic Energy held a hearing on March 12, 1958, at which representatives of the Atomic Energy Commission testified concerning proposed arrangement No. 58–111–4 between the AEC and Nuclear Development Corp., of White Plains, New York.

The hearing was held pursuant to section 111b, of Public Law 85–162, the AEC Authorization Act for the current fiscal year 1958, which requires the Commission, before entering into any proposed arrangement or amendment thereto under the cooperative power reactor demonstration program, to submit the basis of each proposed arrangement or amendment to the Joint Committee for a period of 45 days, unless such period is waived by the joint Committee.

During the hearing it was brought out that if construction of this reactor is later authorized, it will not be constructed at the originally selected site, a comparatively remote location, but instead will be constructed at the site of the existing Chugach Electric Association generating facilities, in a comparatively populated area. In my opinion, this change in proposed site raises doubt as to the advisability of proceeding, in the next phase of the contract, with construction at the location now proposed by the Chugach Electric Association.

As a result of the hearing, the following questions would appear pertinent:

Is it advisable to go all the way to Alaska, and then select a site in a comparatively populated area?

What are the estimated transportation expenses for equipment and personnel to be borne by the Commission in connection with the construction and operation of the reactor in Anchorage, Alaska?

If a site could be found for this reactor in a less populated area, would not the original cost estimates apply, and a savings of approximately $2 million (for containment and remote control instrumentation) be possible?

Would it be possible to find another cooperative electric association to participate in the construction and operation of this project at considerable savings to the Government, and with better protection to the public health and safety?

I would appreciate your comments on the matters raised by these questions.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

ATOMIC ENERGY COMMISSION,
Washington, D. C., April 15, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation, Joint Committee on Atomic Energy, Congress of the United States.

DEAR MR. HOLIFIELD: This letter is in reply to your letter of March 26, 1958, which raised several questions in connection with the Chugach Electric Association nuclear power demonstration plant.

Under the conditions of the power demonstration reactor program the proposer has the responsibility of indicating to the Commission in his proposal the site he concludes is desirable for a demonstration reactor. In evaluating the proposal the Commission takes into consideration the responsiveness of the contemplated site to certain invitation criteria, such as geographical location, cost to the AEC and probable contribution of the proposed project to achieving economically competitive power. In addition, the proposed project and site are subject to eventual detailed scrutiny at the time of reactor hazards review.

In exercising the right of site selection Chugach, in its proposal, indicated location within Anchorage as its preferred choice. It is considered appropriate to quote here from the proposal:

"*Sites*

"After considerable study of the area around Anchorage, two possible sites have been chosen. These are referred to hereafter as sites 1 and 2. Of these, site 1 is the preferred location because of its ease of development and convenience of location. We are not yet certain, however, whether this site will prove fully satisfactory after a complete sites and safety study. We have, therefore, proposed an alternate site located further from the city of Anchorage.

"*Site 1*

"This site is the present Knik Arm steam plant. The plant is located in the northern extremity of the city of Anchorage on Ship Creek. The plant is in a small, deep valley which contains the railroad yards of the Alaska Railroad and a small amount of light industrial development. The nearest residential housing is out of the valley at least one-quarter mile away from the present plant. In the direction of the valley itself, along Ship Creek, there is no residential development in the eastward direction for a distance of 2 miles. In the westward direction the valley ends at the waterfront on Knik Arm. This location is considered excellent as far as general exclusion area is concerned, has sufficient cooling water, rail access, and is, of course, located on the CEA distribution line.

"If this site is used, it would be planned to add an extension on the west end of the existing plant buildings to house the reactor and its associated generating equipment. Such an installation would be designed to produce steam of about the same pressure and temperature as the present new installation in this plant. This will allow use of the present boilers interchangeably with the reactor to supply steam to the turbines in case of reactor shutdown during the early periods of operation. Administrative and accounting functions of the present plant would probably be adequate for the additional number of employees involved in operation of the nuclear plant after the initial operating period.

"This site is ideal from the standpoint of proximity to the electrical load. It is also in excellent position to provide steam to the downtown sections of Anchorage. An effective exclusion area of about one-quarter mile minimum radius exists.

"*Site 2*

"This site is located 12 miles northeast of site 1 on the Eagle River. It is accessible by road from Anchorage and is within a mile of the existing transmission line from Eklutna to Anchorage. This site is regarded as thoroughly satisfactory for a reactor plant, but would be less conveniently located with regard to existing plant facilities and rail transportation. It would also be too far from the Anchorage downtown area to allow economic generation of heating steam. It is, however, located close to important military installations and might be counted upon to provide emergency power in near proximity to these installations."

In the course of subsequent discussions with AEC staff personnel, Chugach stated it was no longer in a position to propose alternate site 2 inasmuch as the location of a plant there would necessitate the acquisition of conventional equipment, the construction of buildings and the extension of a transmission line to the plant. All this would require funding through loans by the Rural Electrification Administration.

In response to an Atomic Energy Commission inquiry, the Rural Electrification Administration stated in a letter dated March 1, 1957: "* * * We are not aware of any circumstances which would cause REA to look unfavorably upon a loan request for additional generating plant. At the time of the request, it would have to be determined that this was the most effective and economical arrangement for meeting the increased power requirements of Chugach. The selection of a suitable site involves economic, technical, and other factors, which, in this case will depend upon the situation that will exist at the time of proceeding with phase III. Consequently, we are in no position to evaluate these factors at this time."

In the absence of definite assurance that an REA loan would be available for location of the plant at a remote site, the AEC and Chugach are proceeding on the assumption that Anchorage will be the site in the event the decision is made to construct. If it should turn out at some later date that funds from REA would be available for convenional equipment at a plant location out of town, we would, of course, be pleased to reconsider.

In your letter you ask if it is advisable to go all the way to Alaska, and then select a site in a comparatively populated area. The attraction of the Alaska area to us is twofold; the opportunity to gain experience and knowledge in the actual operation of a commercial nuclear electric utility in an area of not only very high conventional fuel costs, but also of high costs of labor, materials, etc., and the opportunity to learn of problems and costs involved in shipping over great distances and installing reactor components and fuel elements fabricated in the continental United States. You will note these two factors are independent of location within or without a populated area, except that loan costs to Chugach would result in higher generating costs for an out-of-town plant.

The excess in costs of constructing and operating the proposed reactor in Anchorage over a similar stateside installation will be dependent on a number of factors that can be determined with accuracy only at the time of actual construction and operation. These factors include the difference in labor costs based on stateside and Territorial standard indices at the time and the differences between transportation and communication rates to Anchorage and the rates to the stateside location considered for comparison purposes. The fact that Anchorage is part of a substantial communication and transportation network will presumably help to hold the differential to a reasonable level.

By placing the plant at a considerable distance from a populated area it is possible that containment could be omitted and a resulting saving in costs of approximately $2 million achieved. At the present stage of technology, neither the AEC nor NDA can say with assurance that containment may be omitted, even in a remote area. It is therefore necessary to plan for it at this time. However, there is little expectation that Chugach would be able to obtain funds to finance the conventional portion of the plant in an isolated location, and the Commission is not in a position to furnish funds for this purpose. If, in spite of the extra costs for conventional equipment resulting from location in a remote area, Chugach were able to obtain the necessary financing, then the AEC might realize savings through the omission of containment.

It is possible that some other generating rural electric cooperative might replace Chugach if such action were found to be advisable. We are not aware, however,

of any such potential substitute having the advantages noted above associated with location in Alaska.

To summarize, it is concluded that:

(*a*) Lack of positive information to the contrary makes it advisable for us to assume at this time that containment will be required regardless of location;

(*b*) There is low probability that REA would approve a loan for plant location in a remote area in view of the increased operating costs and carrying charges. Therefore, insofar as Chugach participation is concerned, the Anchorage location must be included in any planning; and

(*c*) The present assumptions concerning containment and location may be subject to change approximately 2 years in the future when it is anticipated that a decision will be made whether or not to go ahead with construction.

As explained in the Commission letter of February 7, 1958, to the joint committee, we plan to reach a decision by June 30, 1958, whether or not to extend the existing contract with NDA to provide for definitive research and development. In the event the Commission should conclude approximately 2 years later that reactor construction would be desirable, any resulting basis for agreement will be submitted to the joint committee as required by Public Law 85–162.

If we can be of further assistance, please do not hesitate to call upon us.

Sincerely yours,

R. W. Cook,
Deputy General Manager.

(Thereupon, at 11:10 a. m., Wednesday, March 12, 1958, the subcommittee was recessed, to reconvene at 10 a. m., Friday, March 14, 1958.)

REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

FRIDAY, MARCH 14, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to notice, at 10 a. m., in room 457, Senate Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Holifield, Durham (chairman of the full committee), Price, Van Zandt; Senators Pastore and Dworshak.

Present also: James T. Ramey, executive director, and David R. Toll, staff counsel, Joint Committee on Atomic Energy.

Representative HOLIFIELD. The committee will come to order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning to receive testimony from AEC officials concerning proposed arrangement No. 58–111–5 with East Coast Nuclear Group, a group of Ohio Valley area companies; and Florida West Coast Nuclear Group, two Florida utilities.

The proposed arrangement is directed to research and development, construction, and 5 years operation of an advanced, high temperature, gas cooled, heavy water moderated reactor of the pressure-tube type.

The Commission forwarded program justification data for the proposed arrangement to the committee by letter dated February 28, 1958, and, without objection, I would like to insert in the record a copy of the letter and the program justification at this point.

(The document referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., February 28, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy.

DEAR MR. DURHAM: There is transmitted herewith proposed legislation which would amend Public Law 85–162 which authorized appropriations for the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for the other purposes.

The proposed legislation would amend sections 101 and 111 of Public Law 85–162 in the following manner:

1. Section 101 would be amended to increase the current authorization for appropriations by $35 million to provide for construction of a destroyer reactor prototype facility.

2. Section 111 would be amended to—

(*a*) Permit the waiver of charges for the use of heavy water in any reactor under the third round, power reactor demonstration program; and

(*b*) Permit the utilization of funds appropriated to the Commission pursuant to the authorization in subsection 111 (a) of Public Law 85–162 and authorized for the third round of the Commission's power reactor demon-

stration program in a cooperative arrangement for an advanced, high-temperature, gas-cooled, heavy water-moderated reactor.

The Bureau of the Budget has advised us that enactment of this legislation would be in accord with the program of the President.

A detailed analysis supporting these amendments is being transmitted to the Joint Committee on Atomic Energy.

Sincerely yours,

LEWIS L. STRAUSS, *Chairman.*

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58-111-5

A. Name of contractors

1. *Prime contractors.*—
East Central Nuclear Group (a group of Ohio Valley area companies), Florida West Coast Nuclear Group (Florida Power Corp. and Tampa Electric Co.).

2. *Principal subcontractors are expected to be.*—
General Nuclear Engineering Corp. (principal design agent and nuclear project engineer for research and development). American Gas and Electric Service Corp. (principal design and construction engineers).

B. Description of proposed project

1. *Objectives.*—The objectives of the proposed project are to bring new resources into the development of nuclear power technology, to advance the art, and to accelerate the time when economically competitive nuclear power is achieved. These objectives are to be achieved by a proposed arrangement which, on the terms given below, is directed to the research and development, construction, and 5 years' operation of an advanced, high-temperature, gas-cooled, heavy water-moderated reactor of the pressure tube type. The reactor would be a unit of about 50 EMW fueled by slightly enriched uranium, which the proposers would design as a prototype of a 200 electric megawatt reactor capable of operating on natural uranium fuel.

2. *Location.*—The proposed plant will be located on the systems of the FWCNG member companies.

3. *Technical aspects.*—(Data are approximate and will reflect the choice of either steel or beryllium for the fuel cladding material, as shown.)

	Steel	Beryllium
Reactor heat output	229 megawatts	173 megawatts.
Electrical output (net)	61 megawatts	46 megawatts.
Type of fuel: UO_2.		
Amount of fuel loading: 15.4 tons.		
Enrichment	1.78 percent	1.15 percent.
Moderator: D_2O.		
Coolant: CO_2.		
Reactor outlet temperature	1,020° F	1,070° F.
Reactor pressure: 520 pounds per square inch, absolute.		
Steam conditions: 1,000° F., 1,000 to 1,800 pounds per square inch.		
Byproduct utilization: Not yet determined.		

4. *Estimated date of completion.*—June 1963.

C. *Estimates of cost (in thousands)*

	AEC	Florida-West Coast Nuclear Group	East-Central Nuclear Group	Total
1. Preconstruction research and development:				
Research and development	[1] $5,097	$250	$4,848	$10,195
Use of AEC facilities	[1] 1,000	0	0	1,000
Administrative and assigned personnel	0	170	1,745	1,915
Subtotal	6,097	420	6,593	13,110
2. Design and construction:				
Engineering design	0	2,100	0	2,100
Construction	0	23,785	0	23,785
Subtotal	0	25,885	0	25,885
3. Postconstruction costs:				
Excess operating costs (5 years)	0	5,426	0	5,426
Research and development (5 years)	3,000	0	2,000	5,000
Subtotal	3,000	5,426	2,000	10,426
4. Waivers:				
Waiver of heavy water use charge (5 years)	450	0	0	450
Waiver of fuel use charge (5 years)	350	0	0	350
Subtotal	800	0	0	800
5. Total	9,897	31,731	8,593	50,221
6. Research and development overrun at AEC option	[1] 2,549	2,549		5,098
Administrative and assigned personnel	0	958		958
7. Grand total	12,446	43,831		56,277

[1] These amounts are maximums.

D. General features of proposed arrangements

The proposed arrangement consists of a research and development phase to be followed, under certain terms and conditions as given below, by construction and operation of the reactor for a 5-year period. In general, the proposal provides that the cost of the research and development programs will be shared in approximately equal amounts by AEC and the utility groups, and that Florida-West Coast Nuclear Group will pay the costs incurred in construction of the prototype reactor.

1. *Site.*—The site for the nuclear powerplant will be selected and provided by Florida-West Coast Nuclear Group and be subject to approval by AEC.

2. *Construction.*—The nuclear plant will be constructed by Florida-West Coast Nuclear Group, following the decision to proceed with its design and construction. Terms governing the initiation of construction are as follows:

a. Construction will be contingent on a determination of technical feasibility to be made at an appropriate time by mutual agreement (or by AEC in the absence of agreement).

(*b*) Florida-West Coast Nuclear Group may elect not to construct the prototype if, after research and development, competent engineers mutually selected estimate that the cost of power from the reactor during its third through fifth years of operation (assuming AEC source and special nuclear material and heavy water use charges and credits then predicted for that period) would exceed by more than 50 percent the power costs estimated for a hypothetical conventional plant of 120 electric megawatts that would otherwise be built on the Florida-West Coast Nuclear Group systems.

(*c*) Proposers may also terminate if at the time prototype construction were to be begun, it is AEC's judgment that there is conclusive evidence that some other reactor type, no less advanced in its state of development, would produce power clearly more economical than the proposers' projected 200-electric megawatts plant.

3. *Operation.*—Florida-West Coast Nuclear Group will operate the plant for 5 years as part of its members' power systems.

4. *Financial assistance.*—The preoperational research and development program is designed to yield the further information necessary to permit the parties to make a prudent decision on construction of the plant. Costs of the base preconstruction research and development program, under a ceiling of $10.195 million, will be shared equally and concurrently by AEC and the proposers. If, after work is begun, it appears that preconstruction research and development costs will exceed the base amount, AEC may either withdraw after expenditure of the base amount, or AEC may require further research and development expenditures up to 50 per cent ($5.098 million) of the base amount, to be shared equally by AEC and the proposers. Decision to incur further overruns might be made by mutual agreement. In addition to the above, AEC will provide research and development in AEC facilities up to $1.0 million and the proposers will provide administrative and assigned personnel at an estimated cost of $1.915 million during the base period and up to $0.958 million during the overrun period. During the 5-year operating period, AEC will provide up to $3 million and the proposers will provide $2 million toward a postconstruction research and development program estimated at $5 million total.

AEC will also waive 5 years' use charges on fuel valued at $0.35 million and on heavy water valued at $0.45 million.

5. *Title.*—Florida-West Coast Nuclear Group will be the sole owner of the nuclear powerplant.

6. *Term.*—The term of the contract will extend until the expiration of 5 years after the date the plant first operates, unless the contract is terminated earlier under the provisions discussed in items 2, 4, and 8.

7. *Indemnity.*—As a licensee of the Commission, the proposers will be subject to the provisions of Public Law 256, 85th Congress.

8. *Termination.*—In addition to the termination provisions contained in 2 and 4 above, the project may be terminated at any time by mutual agreement. AEC may also withdraw at the time the base research and development amount of $10.195 million has been expended, at which time the project may or may not be continued by the remaining parties. Under any termination the obligation of each party will be its share of expenses up to termination date.

The respective obligations of the utility groups are subject to obtaining adequate liability insurance and indemnity coverage and all regulatory approvals required for them and their members.

9. *Patents.*—AEC shall have the right to determine title and all rights to inventions originated in the course of research and development work in connection with the development, construction and operating phases of the project, provided that East-Central Nuclear Group, Florida-West Coast Nuclear Group, their member companies and any subcontractor originating the invention shall retain at least a nonexclusive, irrevocable, royalty-free license. Except as otherwise authorized by AEC, East-Central Nuclear Group will include a similar patent provision in all subcontracts for research and development work.

10. *Licenses.*—The proposers will undertake to obtain all necessary licenses from AEC, and such other necessary approvals from Federal, State, and local regulatory agencies as are required to permit the construction and operation of the plant and the sale or use of the energy produced therein.

11. *Information and records.*—In addition to statutory requirements, proposers will make available to AEC such technical and cost information regarding development, construction and operation of the prototype reactor as will enable AEC to fulfill the purposes of the power demonstration reactor program.

12. *Responsibilities of the proposers.*—East-Central Nuclear Group will assume contractual obligations for the preoperational and postoperational research and development programs. Florida-West Coast Nuclear Group will assume contractual obligations for construction and operation of the reactor plant, and, in addition, will participate in other phases of the project.

Representative HOLIFIELD. Also in this letter of February 28, the Commission requested an amendment to Public Law 85–162, the current fiscal year 1958 authorization act.

The proposed amendment would amend the authorization act in certain respects to permit the commission to proceed with proposed arrangement No. 58–111–5 for the Florida reactor, and it would also authorize $35 million for construction of a destroyer reactor plant at West Milton, N. Y.

If time permits, the subcommittee hopes to consider these matters this morning following the testimony concerning the proposed Florida reactor.

Originally, the subcommittee had also planned to receive testimony today concerning the proposed assistance to the Pennsylvania Power & Light Co. and Westinghouse Co. reactor, but this hearing has now been postponed and rescheduled for a hearing Saturday, March 22, 1958.

We have this morning, as representatives of the Commission, the General Manager, Mr. K. E. Fields, and the Director of the Division of Reactor Development, Mr. W. K. Davis. We are glad to have you with us this morning, gentlemen. Will you please proceed.

(The bill under consideration follows:)

PROPOSED BILL FOR AUTHORIZATION OF APPROPRIATIONS PURSUANT TO SECTION 261 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND FOR OTHER PURPOSES

A BILL To amend Public Law 85–162 to increase the authorization for appropriations to the Atomic Energy Commission in accordance with section 261 of the Atomic Energy Act of 1954, as amended, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 101 of Public Law 85–162 is hereby amended by striking the figure "$222,230,000" and inserting in lieu thereof the figure "$257,230,000".

SEC. 2. Section 101 (e) of Public Law 85–162 is amended by adding at the end thereof a new subsection, reading:

"16. Project 58–e–16, destroyer reactor plant, West Milton, New York, $35,000,000."

SEC. 3. Section 111 of Public Law 85–162 is amended by adding thereto:

"(c) Funds appropriated to the Commission, pursuant to the authorization contained in subsection (a) of this section and authorized for the Third Round of the Commission's power reactor demonstration program, shall be available to the Commission for cooperative arrangements which may provide for the waiver by the Commission of its charges for the use of heavy water for a period not to exceed five years in any proposed reactor otherwise eligible for assistance under the Third Round.

"(d) Funds appropriated to the Commission, pursuant to the authorization contained in subsection (a) of this section and authorized for the Third Round of the Commission's power reactor demonstration program, shall be available to the Commission for a cooperative arrangement in accordance with the basis for an arrangement described in the Program Justification Data numbered 58–111–5."

(This portion of the hearing of March 14, 1958, pertaining to authorization of the destroyer reactor plant, has been printed separately entitled "Authorizing Legislation for Destroyer Reactor Plant.")

26931—58——3

STATEMENTS OF K. E. FIELDS, GENERAL MANAGER; W. K. DAVIS, DIRECTOR; AND D. M. MORRIS, ASSISTANT DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; AND DONALD BURROWS, COMPTROLLER

Mr. FIELDS. Mr. Chairman, I have just a few outline remarks to make.

Mr. FIELDS. Two of the amendments pertain to section 111 of the 1958 authorization act. The first of these, which is a new subsection (c) to section 3 of that law, would authorize the waiver of use charges for heavy water under the third-round invitation of the power reactor demonstration program.

As you recall, our conditions were that we would waive this use charge in the case of reactors to be fueled with normal uranium.

Now, our invitation specified that we would include this waiver for third-round proposals. Since that time, we have received several proposals which have requested this same assistance for reactors which are designed to be fueled with other than normal uranium.

Two of these are the Pennsylvania Power & Light Co. Westinghouse project and Carolina Nuclear Power Associates project.

I will not outline the details of those projects any further than to say that they have requested this waiver.

Now, in order that we can proceed in dealing with those expeditiously and because this similar request for waiver is in the proposal of the East Central Nuclear Group and the Florida West Coast Nuclear Group, we are requesting that section be amended so that a waiver could be given on a use charge for heavy water in all third-round proposals.

We can come back to that later.

May I just make a last statement, sir, with respect to the last change?

The second change to section 111 of the 1958 authorization act would add a new subsection (d):

> To authorize the use of funds appropriated to the Commission under the authorization contained in subsection (a) of section 111 in connection with the proposal submitted by the East Central Nuclear Group and the Florida West Coast Nuclear Group.

Now, this proposal conforms, generally, to the criteria of the third round, and it was arrived at during negotiations conducted under the basic approach of the third round.

There are two deviations from the third-round criteria, though, that are such that we believe it should be specifically authorized in order to proceed. The two deviations from the third-round criteria considered by your committee in connection with the authorization bill are these:

First, under this proposal the completion of construction is estimated as June 1963, whereas, as you will recall, Mr. Chairman, the third-round criteria provided for a completion date of no later than June 1962.

The second deviation from the third-round criteria of this proposal is as in the case of the two I referred to before; it also requests a waiver of the heavy water use charge for a prototype reactor which will utilize slightly enriched uranium rather than normal uranium as specified in the third round.

Now, we would hope that these two amendments will be acceptable to your committee so that we can proceed with the negotiations of the contract with East Central Nuclear Group and the Florida West Coast Nuclear Group.

We have transmitted the program justification data sheets as you have indicated and we would hope that if this proposed section 111 (d) is enacted that the 45-day filing requirement of section 111 (b) would not be applicable to this proposed arrangement with East Central and Florida West Coast Nuclear Groups.

I would say one thing further in connection with this proposal.

We consider it very worthwhile that in going forward with it we would have talents in the organizations involved that are the kind of talents that we want to draw into this program, that it is on an advanced type of reactor that is of great interest to proceed with, and that this fact and the fact that this group is proceeding and is ready to proceed very rapidly on this project is why we are in here requesting this authorization to change to the authorization for 1958.

Now, Mr. Chairman, we are prepared to go into further details as you wish at this point. We can make further statements with respect to the general features of this proposal if you wish, or however you wish to proceed.

I do understand you have other witnesses here from the proposers that you wish to hear, also.

Representative HOLIFIELD. General Fields, did the Commission notify the committee that it turned down the original Florida project?

Mr. FIELDS. I believe we did, sir. I presume we did. I would have to check, but I presume we did.

Representative HOLIFIELD. The staff informs me that we have no such notification.

Mr. FIELDS. I will check that at my first opportunity, sir. If we did not it was certainly an oversight.

Representative HOLIFIELD. Now, I think you issued a press release which was the first the committee knew about it. And I note one other thing of interest, that your press release did not indicate that it would take another year that you are now asking.

The press release retained the date of June 1962, rather than the new date which you are now requesting, June 1963.

Mr. FIELDS. Mr. Chairman, if this is the case it is an error. At the time the press release was issued I am sure we were aware of this completion date.

Representative DURHAM. General Fields, is there any other group coming under this amendment beside the East Florida Group?

Mr. FIELDS. On the amendment with respect to heavy water there are potentially two other groups at this time, the Pennsylvania Power & Light, and the Carolina-Virginia Group.

Each indicated if their proposals go ahead they would request the waiver on heavy water, sir.

Representative DURHAM. Is that all at the present time that you have proposals from?

Mr. FIELDS. Yes, sir.

Representative DURHAM. I am thinking that you might come in here and ask us to amend the law again on some proposals you have

down there at the present time, you would keep amending this every year, which we hope will not happen.

Mr. FIELDS. In the sense of the amending of the criteria, I do not believe that would be a necessity.

Representative DURHAM. This cleans up the third round?

Mr. FIELDS. Well, we will appear before you, I believe it is March 22, on the Pennsylvania Power & Light. Insofar as authorization changes, this should do so with the exception that when we discuss the subsequent proposals, these two, we will have to deal with the overall amount of the authorization if all of them come in, sir, not in the sense of changing the criteria, however.

Representative DURHAM. I was thinking of this. Of course we like to treat them all alike. If you have other proposals that do not have a completion date in 1963, you run into the same situation. Will the Pennyslvania Power & Light proposal as submitted to you, be later?

Mr. FIELDS. Yes, sir; but that is a homogeneous reactor and I believe it is presently covered or you could interpret the present authorization that it would be covered because we did indicate there would be a later date on the homogeneous-type reactor in the authorization of 1958.

Mr. RAMEY. I think that is correct, Mr. Chairman. It said something to the effect that it would go from July 1, 1962, to July 1, or later, 1963.

Mr. FIELDS. Insofar as the date we have none in hand that would require a change in the authorization that I am aware of, Mr. Durham, except this one.

And recognizing that the homogeneous reactor in the authorization act would be in later——

Mr. RAMEY. On the Pennyslvania one, will you resubmit the basis of that arrangement for committee review under the 45-day period when you go into the construction phase?

Mr. FIELDS. Yes, sir; I am certain that we would if it goes through on the present basis that we have submitted, sir.

Representative DURHAM. Will you do that on the Florida Group?

Mr. MORRIS. I think this would not be necessary on the Florida?

Mr. RAMEY. On the Pennsylvania one the company has a right to terminate the project and the Commission also has certain rights to look it over.

Would it not make sense also, in the case of the Florida one, to do the same thing?

Mr. MORRIS. The distinction between the two is that in the Pennsylvania case the contract we contemplate entering initially would not cover the commitment to construct the reactor. This would require a modification of the contract.

In the Florida case the contract we contemplate would cover the construction of the reactor with certain termination rights specified.

Representative DURHAM. That contract with Pennsylvania is based on the commitment for a certain period of years whether or not it is going to be useful.

Mr. MORRIS. The initial commitment is for 2 years of research and development, at which time the parties will decide whether construction will be entered into and a contract modification will be executed.

Representative DURHAM. In a case like that, in case they decide to go ahead, would there be any reason why they would not go ahead and construct the reactor under this amendment to the act or would that prohibit them?

Mr. FIELDS. We feel we would have authority for them to go ahead, but in answer to Mr. Ramey's question, I believe the modification of the contract at that time would be submitted to this committee. It would not be a matter of terminating if they failed to go ahead, but modifying the contract to go ahead with construction if they went ahead.

Representative HOLIFIELD. Getting back to the Florida project, do you consider that the completion date of June 1962 is impossible?

Mr. FIELDS. In the discussion with the proposers, the companies, they estimate the completion date somewhere between the end of 1962 or the June 30, 1963, date, as being more realistic.

They do not believe it is possible to meet that date of June 30, 1962. I think we concur in this.

I should not say we think—we do.

Representative HOLIFIELD. Is this because of the failure of the Florida people to come up with a firm proposal or is it because of the Commission's lag in negotiating this contract?

Mr. FIELDS. Mr. Chairman, I would say that it is largely because it is an advanced-type reactor with a considerable amount of research and development to be done, that the proposal at the time it was initiated stated at the time it would not be possible to conduct the necessary research and development and permit the construction in this time period, sir.

You see, this is an advanced type that offers promise, that has not been under active development elsewhere. It is of a kind that I think we want to do under the third round.

It did not come forward initially when the third round was first proposed. It just had not been born at that time, I guess, sir.

Representative HOLIFIELD. Now, the procedure in this instance, as I understand it, is that the AEC will provide $6,097,000 in preconstruction research and development and there are many opportunities in this arrangement for the proposers to terminate further work on the project if in their own judgment at the end of that period of time when that amount of money has been spent, they decide not to go into it.

Under that situation there is no financial obligation on the part of the proposers; is that right?

Mr. FIELDS. Mr. Chairman, the setting of this should be accepted, I believe, on this basis: Here is a project starting out in research and development in which the research and development costs will be shared on a 50–50 basis, very close to a 50–50 basis, between the Government and the proposers.

As these costs are incurred it is on that basis, sir. Now, we have the authority to invoke a 50 percent increase in the amount of research and development and proceed again on this 50–50 basis. So that is money that they have expended as well as the Government in a very worthwhile development project.

Representative HOLIFIELD. In other words, you are setting aside $6 million of Government money and they must match that?

Mr. FIELDS. They must match that.

Representative HOLIFIELD. And you spend it concurrently?

Mr. FIELDS. And we spend it concurrently; yes, sir. It is completely a participating joint project here for that development work, joint in the sense of sharing the research and development costs also during that period.

I am sure that the committee, judging from the testimony last year, I am sure that the Commission and I am sure the proposers, feel that development should proceed to result in promising reactor types that should go forward if the conditions warrant going further as you proceed in the steps down the development path, and that there should not be a commitment to build an obsolete reactor that will not perform after you have done this work.

So, here is a proposal that really came, on our part, as I suppose consideration on their part, out of the thinking that everyone has done since last year, of getting participation in research and development with the promise of building the reactors if the reactors after you have done the development warrant being built.

This is the basis upon which this is set.

Representative HOLIFIELD. Is there an equal exchange or mutual exchange of research and development information between the proposers and the Government in this mingled fund of approximately $12 million?

Mr. FIELDS. In the what, sir?

Representative HOLIFIELD. In the mingled fund.

Mr. FIELDS. We will have the access to the information, patents, and all of this matter, as we have worked out in the previous proposals, sir, yes, there will be complete freedom on the information exchange.

Representative HOLIFIELD. It is not two separate projects. It is one project with mingled funds; is that right?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. Now, what happens if the research and development runs over the $5,098,000 provided in the proposal?

Mr. FIELDS. I do not quite follow your question. It is $10 million, sir.

I presume you mean $10 million because it is on a 50–50 basis.

Representative HOLIFIELD. I was referring to page 2, C–6: "Research and development overrun at AEC option."

The total there is $5,098,000.

Mr. FIELDS. At that point the construction would either proceed or if the conditions are such that the company determined to terminate, they could terminate. Or if by mutual agreement we determined that another course could be followed, it would be by mutual agreement, sir.

Representative HOLIFIELD. The $2,549,000 of the AEC, then, would be matched by the sponsor's same amount?

Mr. FIELDS. Yes, sir; in the case of the overrun.

Representative HOLIFIELD. So this is an additional obligation on the part of the Government to the $6,097,000?

Mr. FIELDS. That is correct. That is on an optional basis, an option which the Commission could invoke, sir.

Representative HOLIFIELD. Now, referring to page 2, C–3, the post construction costs, for what type of work would the $3 million post construction cost of the AEC be used?

Mr. DAVIS. This would be for actual research and development work which would be done in connection with the operation of the plant. It is not any kind of assistance to the operation, but is research and development, examination of fuel elements, experimental tests, and things of this sort that would be done when the plant is started up. It could be the same kind of things that we are now doing at Shippingport.

We are making very elaborate studies of the heat transfer, the fluxes, the perfomrance of the detailed portions of the core, things of that sort, plus examination of fuel elements taken out of the reactor and things of that nature.

Representative HOLIFIELD. You can state to the committee, then, that this is not a plan for a subsidy for operating costs?

Mr. DAVIS. I can state that.

Representative HOLIFIELD. But it is for genuine research and development work after the reactor is finished?

Mr. DAVIS. That is correct, sir.

Representative HOLIFIELD. Has the site been selected for this reactor?

Mr. MORRIS. A tentative selection has been made, but there has been no announcement on it.

Perhaps Mr. Clapp, who I understand is here, may be able to answer that better.

Representative HOLIFIELD. You cannot state to the committee whether it is in a remote site or a heavily populated area?

Mr. MORRIS. I believe it is not in a heavily populated area, but I prefer Mr. Clapp should answer that since there has been no announcement on it.

Representative HOLIFIELD. Have they consulted with the Reactor Advisory Committee in advance of selecting their tentative site?

Mr. FIELDS. I am not aware of consultations at this moment, sir.

Representative HOLIFIELD. Now, on page 3, paragraphs (d), (b), and (c), under No. 2, there appear to be three conditions which would give an out to the proposers in their program.

Do you consider that to be in effect a release clause?

Mr. FIELDS. It is a release clause in one sense. It is in there because the purpose here is not to require the construction of a plant that does not offer promise or the construction of a plant that after the development has proceeded to this point, might be obsolescent really, compared to other types.

It is a provision that we feel is indicated for advanced type reactor proposal of the nature that this one is.

Representative VAN ZANDT. Is this kind of option written into the others?

Mr. FIELDS. There are normally conditions written into the others under which they would proceed. I am not sure they are exactly the same as this one.

Representative VAN ZANDT. There is one in the Pennsylvania Power & Light Co?

Mr. FIELDS. There is a somewhat similar provision, I believe. It is not in this specific form.

Representative HOLIFIELD. Now, your second proposal was that heavy water be furnished for these plants in the same manner in which you have promised to furnish it for the natural uranium research work?

Mr. FIELDS. That is correct, sir.

Representative HOLIFIELD. This will involve about how much additional cost to the Government?

Mr. FIELDS. I believe that is covered in one of the justification data sheets, sir. It would involve during the period of this development work, which is to take place in this 5-year period, and these are development projects, all of them, an estimated amount of $950,000 in the case of Pennsylvania Power & Light.

Representative HOLIFIELD. Let us leave that out. We are not taking Pennsylvania Power & Light.

Mr. FIELDS. It is $450,000 in the case of the instant proposal we are discussing.

Representative HOLIFIELD. $450,000; that is for the 5-year operating period?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. You are also furnishing them free fuel, I understand, for that period?

Mr. FIELDS. There will be a waiver of the fuel use charge in that same period, that would be in the amount of $350,000, sir.

These are all totaled under that first column of page 2 of that sheet, the justification data.

Representative HOLIFIELD. So the total amount of the Government's participation at the bottom of the page would be $12,446,000.

Mr. FIELDS. In the event the option were exercised and that money were expended.

Representative HOLIFIELD. And that is in the event that the option for the additional research and development is entered into.

Mr. FIELDS. In the event that is entered into, and in the event the reactor is operated for that 5-year period.

Representative HOLIFIELD. Your third point was that you did not think it would be necessary to lay this before the committee for 45 days in case this is consummated.

Mr. FIELDS. Mr. Chairman, our view there is that we have laid before you in this justification data sheet all of the essential details of the arrangement that is proposed, that you have them here now.

And it was my understanding in the previous discussions that when we could do this it would normally be the practice that the committee would issue the waiver at the same time.

Representative HOLIFIELD. Do we have all the essential details?

Mr. FIELDS. It is my belief that you do; yes, sir.

Representative HOLIFIELD. Of course, at the end of your research and development and prior to construction, you plan to lay before us any modification?

Mr. FIELDS. Any modification in accordance with the law would have to be laid before you; yes, sir.

I say any modification. The law has certain conditions under which we would lay it before you. I have forgotten the details.

But if it is a modification that is required to be laid before you, we would certainly intend to. If these conditions change materially, it would be laid before you, also, sir.

Mr. RAMEY. I think at the time the third round was developed and the previous rounds, the research and development and construction phase were regarded as being much closer together and that there would not be this contingency aspect of going into construction, that there is expected to be an obligation for the organization normally to go into construction under the original contract.

Now, all of the proposals that are before the Commission and the committee all are pretty much dependent, and understandably so, and desirably so, on going through a research and development phase and then a construction phase.

But that raises the further question whether or not the Congress ought to take another look at it.

Mr. FIELDS. I think that is a consideration that the committee should deal with. I would say this: that the way this is drawn, if these conditions are met the proposers, I am sure, feel bound to proceed with construction.

Quite beyond that, I believe it would be my judgment that during the research and development phases they will be taking steps in the construction part of this, the acquiring of site and these sorts of things, quite before they come to a final decision whether to build this.

So that in a sense of coming before you again, I do not believe it would be feasible to come before you for the research and development assistance, for example, that is listed here as postconstruction.

We need authorization on that right now to negotiate with them in good faith to come to a contract here.

But in the sense of reviewing it, in that sense, whenever the committee wishes us to be up, we will be up, sir.

But in the sense of the authority to make this commitment now for research and development support during the postconstruction period and for the waivers, we need that authority now, or we cannot enter into this contract.

Maybe I misunderstood, Mr. Ramey; I don't know.

Representative HOLIFIELD. That is a responsive answer, Mr. Fields.

If the proposers elect not to construct the reactor at the end of the research and development period, the question occurs as to what happens to the Government's investment in case there are components or other research equities.

Does the Government have at that time full control of their investment, the benefits of their investment, the results of their investments?

Mr. FIELDS. Mr. Chairman, we will have all the information available to use that will come out of this contract, at that time.

Representative HOLIFIELD. And this might not be a joint determination; the Commission might consider that they should go ahead and the proposers might consider that the promise was not there and they might decide to terminate, as I understand it.

Mr. FIELDS. That is correct. That could happen, Mr. Chairman.

Further, of course, there could be by mutual agreement a proposed modification of the project to proceed on some other basis. That would certainly have to come back to the the Congress.

Representative HOLIFIELD. Before an economical type of reactor had developed in that time period, you might decide to shift to that type rather than this type?

Mr. FIELDS. This could happen.

Representative HOLIFIELD. If that occurs, you would be back before the committee on the modification?

Mr. FIELDS. Yes, sir.

Mr. RAMEY. Would the research results at the time you would make this determination in themselves be of some benefit to your overall reactor program, whether or not you went ahead in the construction?

Mr. FIELDS. I think they would be of substantial benefit, yes. I am optimistic; I don't believe it will be on the pessimistic side.

This is a promising reactor type, but if the development should show that it should not be pursued, that it would not be economic, if that is the conclusion at that time—although I don't believe it will be—that certainly is valuable information to know because of the present belief with respect to this concept.

Representative HOLIFIELD. In order to correct the record, the staff has informed me that the new data is specified in your release. They were confused by another release that was put out.

I am glad to find out that this is not an error on the press release. As I understand, there has been a notable error committed lately in a press release. I am glad to see that this is not an error, also.

Mr. FIELDS. Errors are always regrettable, Mr. Chairman.

Representative HOLIFIELD. I was going to suggest that if it were an error in the press release similar to the 250-mile error that you might check up on your press release department and prevent future errors.

Mr. FIELDS. Errors are always regrettable, Mr. Chairman, and they can have very widespread misinterpretation unfortunately.

Representative HOLIFIELD. Are there any further questions on the Florida site?

Mr. FIELDS. Mr. Chairman, on your previous statement, I would say that was definitely an error on the part of the staff. If the committee so wishes I would think they might want to know all the circumstances, the one you mentioned previously.

Representative VAN ZANDT. What error are you talking about?

Mr. FIELDS. This has to do with the statement with respect to the 250 miles at which this Rainier shot was detected.

Representative VAN ZANDT. The record should show that Congress makes many errors, also. Sometimes in excess of 1,730 miles.

Representative DURHAM. I might say that we will go into that.

Mr. FIELDS. Mr. Durham, I believe it is indicated, and I think that you should know the facts, because it was a regrettable error.

Unfortunately it is being interpreted as proof one way or the other as to how far you can detect tests and it is not by any means all the factors that must be considered in that question.

Representative DURHAM. Will you be prepared in the morning at 10 o'clock?

Mr. FIELDS. I am sorry, sir.

Representative DURHAM. If you have all the facts in the thing it should not take you long to explain it to the committee.

Mr. FIELDS. I did not hear the question.

Representative DURHAM. Could you be ready in the morning at 10 o'clock?

Mr. FIELDS. I do not know why we could not.

Representative DURHAM. Suppose you do it in the morning at 10 o'clock, General Field. Come up and explain the reason for the error.

Mr. FIELDS. Yes, sir. Will this be executive or closed, sir?

Representative DURHAM. Are there aspects that can be published?

Mr. FIELDS. There are aspects than can be published. There are classified items that you may wish to hear further.

Representative VAN ZANDT. Mr. Chairman, I think the only responsibility we have is to determine whether or not it was an error and, if so, who was responsible. All the other information is in the hands of the public already.

Representative PRICE. It has not been cleared up in the minds of the public.

Representative VAN ZANDT. All we have to do, then, is make a report whether or not it was an error and who was responsible.

Representative PRICE. I think we should have an open session. At every opportunity matters should be presented in open session.

Those items involving national security naturally may call for executive sessions.

Representative HOLIFIELD. We had testimony in executive session on January 21 on this very matter and now that the matter has gotten into the press, a committee in the Senate and another subcommittee in the House announced in the morning's paper they are interested. Also this Joint Committee on Atomic Energy is interested.

It seems to me it is the duty of the committee and it should be the privilege of the Atomic Energy Commission to set the record straight on this matter.

If there are no further questions in the Florida proposal, we will excuse these witnesses.

This decision on this particular group, then, is to go the enriched route rather than the natural uranium route which they originally discussed.

Mr. FIELDS. Mr. Chairman, in this prototype they conceive it will be slightly enriched. Perhaps you can deal with it more directly with the proposers.

It has an objective, a bigger plant that may well be natural uranium, but perhaps you can get testimony from them on that particular aspect, sir.

Representative HOLIFIELD. All right, it is not in the Commission's mind that this reactor would take the place of the reactor contemplated in the so-called Kaizer state?

Mr. FIELDS. No.

Representative HOLIFIELD. We will excuse you now and ask the Florida sponsors to come forward.

We have before us Mr. Philip Sporn, president of the East Central Nuclear Group.

Mr. William J. Clapp, president of the Florida West Coast Nuclear Group.

Dr. Walter H. Zinn, president of the General Nuclear Engineering Corp.

Gentlemen, I understand you have brief prepared statements. I suggest that you proceed to present them to the committee.

Mr. SPORN. Would you like me to read our statement, Mr. Chairman.

Representative HOLIFIELD. Yes.

STATEMENT OF PHILIP SPORN, CHAIRMAN, WORKING COMMITTEE, EAST CENTRAL NUCLEAR GROUP

Mr. SPORN. My name is Philip Sporn. I am president of American Gas & Electric Co. and of American Gas & Electric Service Corp.

I am also chairman of the working committee of the East Central Nuclear Group (ECNG), a group of electric utilities operating in the Ohio Valley and contingous areas.

ECNG, together with the Florida West Coast Nuclear Group (FWCNG), has submitted a proposal to the Atomic Energy Commission to carry out a comprehensive program of research and development on an advanced, gas cooled, heavy water moderated, pressure tube reactor.

This proposal is the subject of the proposed arrangement No. 58–111–5 between the Atomic Energy Commission and these two groups, which, in turn, is the subject of this hearing.

I am appearing primarily on behalf of ECNG. Mr. W. J. Clapp and Dr. Walter H. Zinn are also here. Mr. Clapp is president of the Florida Power Corp. and speaks for the Florida West Coast Nuclear Group, which consists of his company and Tampa Electric Co.

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The Cleveland Electric Illuminating Co., Columbus & Southern Ohio Electric Co., the Dayton Power & Light Co., Indianapolis Power & Light Co., Louisville Gas & Electric Co., Ohio Edison Co., and Pennsylvania Power Co., members of the Ohio Edison system.

Southern Indiana Gas & Electric Co., Monongahela Power Co., the Potomac Edison Co., and West Penn Power Co., members of the West Penn Electric system.

The essence of our proposal is that ECNG would carry out a comprehensive program of research and development on this advanced reactor to be financed in approximately equal amounts by the Atomic Energy Commission and the utility groups and that, thereafter, a 50,000-kilowatt (electric) prototype reactor would be constructed and operated for a period of at least 5 years, in Florida, by FWCNG, as hereinafter described.

This reactor would serve as a prototype of a reactor of 200,000 kilowatts.

The present plans, however, are limited to the 50,000-kilowatt prototype.

While it is expected that the reactor in the ultimate 200,000 kilowatts size could operate on natural uranium, the 50,000-kilowatt prototype would require slightly enriched fuel.

Representative HOLIFIELD. May I stop you there and ask you very briefly what the technical problem would be of changing this from an enriched type to a natural uranium type? Is the reactor shell being built in such a way that you can increase the size of your fuel assembly area?

Mr. SPORN. It will not be possible to change the 50,000-kilowatt reactor to use natural uranium, but in the larger size it will be possible.

Representative HOLIFIELD. You are talking about building another reactor, then, that might use the natural uranium; is that right?

Mr. SPORN. We are from the very beginning, Mr. Chairman, going to work on the 200,000-kilowatt reactor in our thinking and our designs and certainly will make preliminary designs to start with, and on the basis of the 200,000-kilowatt designs will develop a prototype design for the smaller 50,000-kilowatt job.

But the prototype will be aimed at the ultimate 200,000-kilowatt unit.

The idea is that the technical problems that could arise in the 200,000-kilowatt job will for all practical purposes be solved and will have been solved in the 50,000-kilowatt prototype.

Representative HOLIFIELD. I believe I understand you, but I want to be sure.

Will this be an adaptation of your original 50,000-kilowatt prototype, or will there be a separate construction of another 200,000.

Mr. SPORN. If there is to be a 200,000-kilowatt job, Mr Chairman, it will be a totally brandnew plant.

Dr. Zinn, I am sure, can add something to this.

STATEMENT OF W. H. ZINN, PRESIDENT, GENERAL NUCLEAR ENGINEERING CORP.

Dr. ZINN. Mr. Holifield and members of the committee, I think on one point there might be some confusion.

One speaks of operating a reactor on normal uranium. Let me make it clear that the 50,000-kilowatt prototype could be loaded with normal uranium and would operate. The trouble is that it would not operate long enough without running out of reactivity, to get the 4,000-megawatt days per ton or more burnup that we have to have in order to show decent fuel economy.

Now, the reason a 50,000-kilowatt machine does not run long enough is simply due to the fact that when heavy water is the moderator, neutrons travel a long way and the reactor is too small physically and too many neutrons escape into the shield.

In the case of a 200-megawatt electrical machine, physically it is larger, and the neutrons do not escape to the shield in the same proportion. We are quite sure from extensive calculations that with normal uranium you do get the burnup which will show economy.

So the word "operating" does not mean will it just turn over; it means will it run long enough.

Representative HOLIFIELD. Then we are talking about reactor A which is a prototype slightly enriched and then its successor, which will be a separate one, B, which will be a large one and might be fueled with natural uranium?

Mr. SPORN. Yes, but our proposal to the Atomic Energy Commission and the subject of this hearing does not contain in it any part of the 200,000-kilowatt job except for the work that we will be doing and hope to be doing successfully to make that possible ultimately.

Representative HOLIFIELD. The benefit of the research and development in the development of hardware will be available for your larger size?

Mr. SPORN. It will be in our work from the very beginning. It is in it right now.

Representative HOLIFIELD. You are not building the two reactors simultaneously?

Mr. SPORN. No, sir; but we are thinking and doing engineering work on the 50,000, keeping in mind the 200,000.

Representative HOLIFIELD. I was trying to differentiate in the record the physical plant from the research and development knowledge which you will acquire.

Mr. SPORN. Yes, the physical plant we are working on is strictly the 50,000-kilowatt unit.

Representative HOLIFIELD. All right, sir, you may proceed.

Mr. SPORN. As I have stated, the reactor would be a high temperature, gas cooled, heavy water moderated reactor of the pressure-tube type.

We would hope to achieve a coolant temperature of about 1,050° F. and a pressure of 500 pounds per square inch.

The basic parameters have been so chosen that an improvement in capital cost over the capital cost for the Calder Hall type reactor is anticipated.

The fuel cycle is to be designed to retain the low cost fuel cycle features which are characteristic of the Calder Hall type of reactor.

However, the high exit gas temperature and the high gas pressure of the proposed reactor would represent a major advance over Calder Hall.

Because of the increased temperature, it is expected that ceramic fuel will be used. Because of the higher pressure, the pressure shell enveloping the reactor would be replaced by pressure tubes.

To increase the possibility of operating the reactor on very low enrichment or natural uranium, heavy water is used as the moderator.

The exit gas temperature is high enough to generate steam at a temperature of approximately 1,000° F. and a pressure of approximately 1,800 pounds per square inch (and we may or may not use that high pressure) and these are the steam terminal values commercially used in advanced conventional powerplants today.

The target specific power of 11.2 megawatt per ton is many times the specific power of the latest Calder Hall design, and, if accomplished, would be a major breakthrough in gas reactor technology.

We believe that, with a comprehensive program of research and development, such a major breakthrough is possible and, indeed, probable, of attainment.

These specifications are along the lines that I consider highly important in making progress toward the goal of competitive atomic power.

By going to high steam pressures and high steam temperatures, we get the maximum electrical kilowatts for a given amount of heat.

Thus a given amount of atomic reactor will give a maximum number of electrical kilowatts. This will make a material contribution toward the reduction in capital cost per kilowatt.

The high pressure, high initial temperature, with its high thermal efficiency, will give a maximum amount of energy for a given amount of nuclear fuel and that will reduce the fuel cost per kilowatt-hour.

The gas-cooled reactor is fundamentally simpler, and presents fewer problems metallurgically at high temperature, than the water-cooled reactor.

Thus, although we have a difficult research problem to solve, it is less difficult than if we attempted to accomplish the same thing in a different concept.

Fnally, we know that Calder Hall has proven to be a successful operation, at least for the conditions encountered in Great Britain.

In my judgment, however, Calder Hall would not achieve for us the goal of competitive atomic power—which is, of course, much more difficult for us than it is for Great Britain—as quickly as would a projection far in advance of the Calder Hall idea into the field of higher temperatures, higher pressures, and the ceramic fuels which, of necessity, will have to come with higher temperatures.

Representative HOLIFIELD. Now, Mr. Sporn, at this point I am going to ask you to place the rest of your statement in the record. The reason I am asking that is because some of the members have to make a 1 o'clock plane in order to go out to New Mexico because of the death of one of our colleagues.

We are going to put the rest of your statement in the record.

(The complete statement of Mr. Sporn follows:)

STATEMENT OF PHILIP SPORN ON BEHALF OF EAST CENTRAL NUCLEAR GROUP (ECNG)

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The essence of our proposal is that ECNG would carry out a comprehensive program of research and development on this advanced reactor to be financed in approximately equal amounts by the Atomic Energy Commission and the utility groups and that, thereafter, a 50,000-kilowatt (electric) prototype reactor

would be constructed and operated for a period of at least 5 years, in Florida, by FWCNG as hereafter described.

This reactor would serve as a prototype of a reactor of 200,000 kilowatts. The present plans, however, are limited to the 50,000-kilowatt prototype. While it is expected that the reactor in the ultimate 200,000-kilowatt size could operate on natural uranium, the 50,000-kilowatt prototype would require slightly enriched fuel.

As I have stated, the reactor would be a high-temperature, gas-cooled, heavy-water moderated reactor of the pressure-tube type. We would hope to achieve a coolant temperature of about 1,050° F. and a pressure of 500 pounds per square inch. The basic parameters have been so chosen that an improvement in capital cost over the capital cost for the Calder Hall type reactor is anticipated. The fuel cycle is to be designed to retain the low cost fuel cycle features which are characteristic of the Calder Hall type of reactor. However, the high exit gas temperature and the high gas pressure of the proposed reactor would represent a major advance over Calder Hall.

Because of the increased temperature, it is expected that ceramic fuel will be used. Because of the higher pressure, the pressure shell enveloping the reactor would be replaced by pressure tubes. To increase the possibility of operating the reactor on very low enrichment or natural uranium, heavy water is used as the moderator. The exit gas temperature is high enough to generate steam at a temperature of approximately 1,000° F. and a pressure of approximately 1,800 pounds per square inch. The target specific power of 11.2 megawatts per ton is many times the specific power of the latest Calder Hall design and, if accomplished, would be a major breakthrough in gas reactor technology. We believe that, with a comprehensive program of research and development, such a major breakthrough is possible and, indeed, probable, of attainment.

These specifications are along the lines that I consider highly important in making progress toward the goal of competitive atomic power. By going to high steam pressures and high steam temperatures we get the maximum electrical kilowatts for a given amount of heat. Thus a given amount of atomic reactor will give a maximum number of electrical kilowatts. This will make a material contribution toward the reduction in capital cost per kilowatt. The high pressure, high initial temperature, with its high thermal efficiency, will give a maximum amount of energy for a given amount of nuclear fuel and that will reduce the fuel cost per kilowatt-hour. The gas-cooled reactor is fundamentally simpler, and presents fewer problems metallurgically at high temperature, than the water-cooled reactor. Thus, although we have a difficult research problem to solve, it is less difficult than if we attempted to accomplish the same thing in a different concept. Finally, we know that Calder Hall has proven to be a successful operation, at least for the conditions encountered in Great Britain. In my judgment, however, Calder Hall would not achieve for us the goal of competitive atomic power (which is, of course, much more difficult for us than it is for Great Britain) as quickly as would a projection far in advance of the Calder Hall idea into the field of higher temperatures, higher pressures, and the ceramic fuels which, of necessity, will have to come with higher temperatures.

In short, there is every reason for pursuing research and development of this particular reactor if our objective is to make a significant contribution to the attainment of competitive atomic power.

In a tabulation annexed to my statement there are summarized the financial arrangements for carrying out the undertaking, including the assistance that the Atomic Energy Commission would furnish. This annex presents in abbreviated form material in the AEC program justification data.

As the tabulation shows, the utilities (and primarily East Central Nuclear Group) and AEC will share, on an approximately equal basis, the costs of research and development. The Florida West Coast Nuclear Group would undertake the construction and operation of the prototype following successful conclusion of the research and development. Also, as indicated in the tabulation, except for waivers of charges for heavy water and for use of fuel, FWCNG would construct and operate the prototype with its own funds and at its own risk.

In carrying out the work, ECNG will administer the entire research and development program. It is expected that Dr. Zinn's General Nuclear Engineering Corp. will be the principal design agent and that Dr. Zinn will be the nuclear project engineer. It is also expected that American Gas & Electric Service Corp., of which I am president, will be principal design and construction engineers for the project.

I would like to make two more points in connection with the project. As will be seen from the tabulation, ECNG is committing itself to an expenditure of close to $8,600,000, with an additional contingent expenditure of approximately $3,500,000, all directed toward bringing about a successful program of research and development to lead to the building and 5 years' meaningful operation of the 50,000-kilowatt prototype.

We have every reason to believe that this program will be successful; if we did not have this confidence, we certainly would not embark on the project and undertake so heavy a commitment for developmental expense. The things that we are going to find out as a result of this expenditure are going to lie in the realm of physics and engineering—science and technology. It will all be in the public domain; and the benefits of what is learned will be available to all groups in the United States, or for that matter in the world, since I assume the information will not be restricted to citizens of the United States. It is because of that that I believe the proposal, besides being a technically exciting one, merits the support of the AEC in the form of a sharing of the research and development costs.

My second point has to do with the commitment by FWCNG to build the 50-megawatt prototype. Under the proposal, the AEC has the right to decide, after consultation with ECNG and FWCNG, whether or not the prototype is technically feasible. If the decision on technical feasibility is in the affirmative, then an economic test is prescribed for determining whether or not the prototype must be built. The test will be a comparison between the estimated cost of power from the prototype and that from a conventional plant which would otherwise be built in Florida at about the same time that the reactor would be built. The size of the conventional plant to be compared has been fixed at 120,000 kilowatts, a size which the Florida companies would normally be installing at that time.

The economic comparison will be made on a basis which assumes conventional financing for the fossil-fuel station. But, for the prototype, 85 percent debt financing will be assumed, with consequent lower fixed charges. Thus, for the hypothetical, fossil-fuel plant, we are assuming conventional conditions—normal size, which admittedly gives a cost advantage over the smaller atomic plant, but conventional financing, which creates a disadvantage as compared with 85 percent debt financing for the atomic plant. The comparison will also use the estimated average cost of the third, fourth, and fifth years of operation of the reactor when higher plant factor is expected to reduce unit costs and when, it is assumed, fuel and heavy water use charges would be waived (such waiver is requested for the first 5 years of operation).

What the proposal provides is that the Florida companies will be obligated to build the prototype unless competent engineers, selected by mutual agreement of all the parties including AEC and using the standards of comparison just described, find that the cost of power from the prototype will exceed 150 percent of the cost of power from the assumed conventional plant. The estimates that we made in submitting our proposal (based on these same standards of comparison) showed cost of power for the prototype of 11.9 mills per kilowatt-hour as against 8.18 mills per kilowatt-hour for the conventional plant. (In making these estimates we also used the conservative figure of $12 per gram for the plutonium credit.) If estimates of this kind prove out after the research and development work is done, then the 150-percent test will be more than satisfied. Even under these circumstances the Florida companies would incur a cost burden of approximately $1 million a year—which they would not experience with the conventional plant—for the assumed 20-year life of the prototype. They should not, in my opinion, be required to assume any larger burden than that.

We believe strongly that this project promises to make an important contribution to the solution of the problem of competitive atomic power. Shortly after we were advised by AEC that our proposal was acceptable as a basis for negotiating a contract—contingent upon necessary action by the Joint Committee and appropriate legislation by the Congress—our groups met to determine what they might accomplish pending consideration of the matter by this committee and the Congress. We decided to, and immediately did, authorize the expenditure of up to $720,000 to carry out the first stages of the program of research and development during the next 6 months. All members of the groups did this willingly but with the understanding that none of us would have an obligation beyond such 6-month period unless, within that time, authorizing legislation can be

adopted and appropriations made available so that AEC is able to execute a contract with us. The Commission has advised us that, if the necessary legislative authorization is adopted, it is prepared to negotiate provisions in a final contract pursuant to which project costs which we incur subsequent to February 3 will be credited to our share of the research and development program. But we are also now incurring such costs with the further understanding that this creates no claim against the Government in the event that, for any reason, contract execution does not take place.

We are confident of the technical soundness of our program. We are confident it will make a contribution to the common fund of knowledge in reactor technology. The East Central Nuclear Group and the Florida West Coast Nuclear Group are enthusiastic about the project. We are willing to spend large sums of our own money over the next few years. In these circumstances, we are most hopeful that your committee will find the project sufficiently solid and worthwhile to support the necessary legislation.

Estimates of cost

[In thousands]

	AEC	FWCNG	ECNG	Total
Preoperational research and development	[1] $6,097	[1] $420	[1] $6,593	[1] $13,110
Design and construction	0	25,885	0	25,885
Postoperational research and development	3,000	0	2,000	5,000
Waiver of fuel and heavy water use charges during first 5 years of operation	800	0	0	800
Excess operating costs during first 5 years of operation	0	5,426	0	5,426
Total	9,897	31,731	8,593	50,221

[1] AEC's contribution of $6,097,000 includes up to $1,000,000 for work to be done in AEC facilities. The FWCNG and ECNG contributions of $420,000 and $6,593,000, respectively, include $170,000 and $1,745,000, respectively, for administrative costs and costs of assigned personnel. In the event of an overrun in the preoperational research and development costs, AEC has the option, by agreeing to pay half of the overrun costs, to require the companies to proceed with further research and development work up to a maximum of $5,098,000; in that case, AEC's share of the overrun would be up to $2,549,000, while the utilities' share would be a like amount plus an additional amount up to $958,000 for administrative costs and cost of assigned personnel.

Mr. SPORN. Thank you, Mr. Chairman.

Representative HOLIFIELD. It is no discourtesy to you, Mr. Sporn.

Mr. SPORN. I thoroughly understand.

Representative HOLIFIELD. We do have to rush along.

Now, Dr. Zinn, your statement is quite brief. Would you like to give it.

STATEMENT OF W. H. ZINN, PRESIDENT, GENERAL NUCLEAR ENGINEERING CORP.—Resumed

Dr. ZINN. I would be quite happy to submit it for the record, sir, and not read it; whichever you wish.

Representative HOLIFIELD. Is there anything in this in particular that you would like to call our attention to, any particular point that is different from your previous presentation?

Dr. ZINN. No, sir; I believe it has been given to the committee before in the 202 hearings, for instance.

Representative HOLIFIELD. It seems to be technical in nature as I look through it. I believe you have presented most of this to the committee before, so we will accept that for the record, sir.

(The complete statement of Dr. Zinn follows:)

STATEMENT OF W. H. ZINN

My name is W. H. Zinn. I am president of the General Nuclear Engineering Corp. of Dunedin, Fla.

The East Central Nuclear Group and the Florida West Coast Nuclear Group have made a proposal to the Atomic Energy Commission for a joint project for the development of a gas-cooled reactor. The reactor in question was proposed to the electric company groups by us and is based on design work performed by my company. The following statement concerning technical matters is therefore made on behalf of the nuclear power groups who have the proposal before the AEC.

The reactor type which we propose shows very considerable promise of being a type which ultimately can achieve the low cost of electricity necessary for nuclear fuel to compete with conventional fuels. In the following paragraphs, some of the characteristics of the reactor are listed and our reasons are given for believing that if these characteristics are achieved a long step toward our goal will have been taken.

1. The coolant gas, either CO_2 or helium, is at a pressure of 500 pounds per square inch. The exit temperature of the gas is 1,050° F.

2. Superheated steam at a temperature of 1,000° F. and a pressure of 1,200 pounds per square inch is generated, hence generating equipment of standard design is used.

3. The fuel material is UO_2 or other form of ceramic uranium. The high exit temperature of the gas makes the use of uranium metal impractical.

4. The high pressure of the gas prohibits the use of an enveloping pressure vessel. Instead, the gas is confined by pressure tubes which pass through the reactor.

5. The reactor proposed is a prototype which, in size, is large enough so that scale-up to a reactor of 200 electric Megawatts or more will not require the solution of new basic or development problems.

6. The prototype proposed will be fueled with uranium enriched to 1.15 percent, but a full-scale reactor would operate satisfactorily on natural uranium. The reason that the prototype must be enriched is the large neutron leakage into the shield. The large leakage of neutrons into the shield is due to the fact that the core diameter of the reactor is only 10 feet.

7. Heavy water is the moderator for the reactor and has been chosen because more spare reactivity is available with this moderator than with any other.

8. Calculations indicate that a large reactor of this type, fueled with natural uranium dioxide, can achieve a burnup before reactivity loss limits the exposure which is in excess of 4,000 megawatt-days per ton. Since fueling with natural uranium means that the actual fuel burned is the cheapest U–235 available, the net burnup cost with $12 per gram plutonium credit will be a fraction of a mill per kilowatt-hour. Even without any plutonium credit, the net burnup cost is less than 1½ mills per kilowatt-hour. Omitting the plutonium credit also permits dispensing with chemical processing of the spent fuel and the associated cost.

9. The prototype reactor is to generate 50 Megawatts of electricity. At this size, equipment components also will be of such size that scale-up for use in a large-scale reactor powerplant will not be a serious problem.

10. In a full-scale reactor, very slight enrichment of the uranium may permit further extension of the burnup and therefore still further decrease the net burnup. It is believed that the reactor in either its natural or very slightly enriched uranium version will have the lowest net burnup cost of any reactor.

11. Fuel element jackets are to be beryllium metal or a ceramic material. For the prototype, alloy steel can be used. The operating surface temperature of the fuel is to be 1200°F. or more, which for reactors is a high figure.

12. Per unit of energy developed, the fabrication cost of the fuel is expected to reach an acceptably low figure. The reasons for this expectation are as follows:

(*a*) With gas cooling, coolant passages are relatively large and therefore precise tolerances need not be maintained.

(*b*) The individual fuel bodies are loaded into tubes in the reactor which eliminates any additional expensive supporting structure.

(*c*) The tube reactor permits early detection of faults in fuel element jackets. This materially reduces the penalty associated with the development of a fault in a jacket and reduces the requirements for integrity testing in manufacture.

13. The specific power of the reactor is to be in excess of 10 megawatts of heat per ton of fuel, which is very high for gas cooling. It is comparable to what is obtained with liquid-cooled reactors, and is the direct result of the use of high pressure and high temperatures for the gas. Raising the specific power of a

gas-cooled reactor is expected to largely remove the capital cost disadvantage which up to this time gas-cooled reactors have been supposed to incur.

14. High pressure and high temperature for the gas issuing from the reactor also permit more efficient construction of the heat conversion equipment exterior to the reactor. This acts to reduce capital cost.

15. High temperature improves the overall efficiency, thus giving more electricity for each capital dollar.

16. The materials chosen for this reactor system, both within the reactor and in the primary gas circuit, are not subject to corrosion difficulties. For much of the system, ordinary steel can be used, and the expense associated with the use of highly corrosion-resistant materials, such as stainless steel, is avoided.

17. It is a requirement of this reactor that the fission products be confined within the fuel elements. Due to the fact that the gas to be used as coolant will not become radioactive nor contain radioactivity, conventional methods for maintenance of the equipment of the primary circuit suffice. This point is of considerable importance in achieving low operating and maintenance expense for a nuclear powerplant.

18. Due to the fact that an individual fuel element is physically small, having a length of approximately 2 feet, it is possible to add or remove fuel from the reactor in small increments. This means that each fuel element can be exposed to the average burnup without, at the same time, requiring some part of a fuel element to undergo about twice the average burnup, and, hence, twice the average radiation damage. This is in contrast to our pressure vessel water reactors in which some part of each fuel element must withstand about twice the average burnup. For the same reasons, the excess reactivity which must be controlled with the control and safety system of the reactor can be held to a minimum, thus simplifying the control system and reducing the hazard associated with the manipulation of large amounts of reactivity.

19. The research and development program proposed contains many problems to which solutions must be sought. Two problems are of major importance: that is the development of a suitable pressure tube which will have a life in the reactor of approximately 15 years and the development of a high-temperature fuel element having a jacket impervious to fission products. Present information indicates that there is a good prospect for achieving success in these developmental efforts.

20. In summary, the proposed reactor type, in our judgment, will lead to acceptably low fuel cost, will reduce capital costs for gas-cooled reactors, and will not be penalized with excessive maintenance costs because of the need to work with highly radioactive components. Also, since in large scale it is fueled with natural uranium, an opportunity exists to add this highly attractive feature to the United States program.

Representative HOLIFIELD. Mr. Clapp, your statement is a page and a half. I suggest you read it to us, please.

STATEMENT OF W. J. CLAPP, PRESIDENT, FLORIDA POWER CORP.,

Mr. CLAPP. My name is W. J. Clapp, and I am president of the Florida Power Corp., St. Petersburg, Fla.

I am here today representing the Florida West Coast Nuclear Group, which is composed of the Tampa Electric Co., Tampa, Fla., and the Florida Power Corp. The statement that I am making is on behalf of these two companies, and is confirmation of the statement that Mr. Philip Sporn has just made regarding our participation in a joint venture with the East Central Nuclear Group.

The 2 Florida power companies combined serve a population of a million and a quarter people, over an area comprising 33 of the 67 counties in the State of Florida.

Our transmission systems have been interconnected for years, and the two companies' service areas are immediately adjacent to each other on the west coast of Florida.

We have a combined electric generating capability today of 1,030,000 kilowatts. Our loads have been doubling every 5 years, and we estimate that our combined powerplant facilities will total 2,075,000 kilowatts by 1963.

The 2 companies, as of the end of 1957, had a total investment of $343,627,000 to serve the more than 375,000 customers on our lines.

To keep up with the rapid growth of Florida, we have had to expend for new construction during the past 5 years a total of $190 million.

Between now and 1963 we estimate the 2 companies will have to spend an additional sum of $321 million to keep up with the continued growth.

I appreciate this opportunity of appearing before you gentlemen today, to give you assurance that the Tampa Electric Co. and the Florida Power Corp. are in a position to undertake the construction of the nuclear plant as proposed jointly by the East Central Nuclear Group and ourselves.

We are sincere in this determination, and feel that we can make a substantial contribution to the advancement of the nuclear art and benefit of our customers by participating in this research and development program, which we hope will lead to a second source of boiler fuel for the State of Florida.

Thank you, sir.

Representative HOLIFIELD. Thank you, Mr. Clapp.

Your understanding as to your rights of termination coincide with the presentation made by General Fields, I suppose?

Mr. CLAPP. Generally, yes, sir; and in Mr. Sporn's statement in detail.

Representative VAN ZANDT. Mr. Clapp, what fuel do you use in the boiler now?

Mr. CLAPP. Practically all the boiler fuel is fuel oil from Texas, mostly.

Representative VAN ZANT. Mr. Sporn, on page 4, you make reference to Calder Hall, and the fact that it does not produce competitive atomic power.

Have you been able to arrive at a cost per kilowatt-hour?

Mr. SPORN. The calculations I make for our conditions, and I have made a number of them myself, both on the basis of information that was published and on the basis of discussions I have had with the people in England, lead to something in the order of 12 mills per kilowatt-hour.

This is not competitive in my judgment, in most of the areas of the United States. It definitely is not competitive in Florida, for example, where we are working now on this project.

Certainly it is not competitive in Western Pennsylvania, in the Ohio Valley, where we operate, and have for many decades.

Representative VAN ZANDT. This 12 mills per kilowatt-hour, was it based on using United States labor, and material costs?

Mr. SPORN. Yes, sir; because fundamentally we would not be able to erect a reactor in the United States except with American labor and American materials. I do not think we would go outside for it.

Representative VAN ZANDT. What is the average cost per kilowatt-hour in Florida of conventional power?

Mr. SPORN. We made a study for the Florida West Coast Nuclear Group in connection with this and came to the conclusion that for present fuel costs, operating the same number of hours that they figured that this reactor would operate, 7,000 hours a year, and using conventional utility, financing, and taxes that would be about 8 mills per kilowatt-hour at the present time.

Representative HOLIFIELD. What is your projection for this 50,000-kilowatt plant?

Mr. SPORN. About 11.9 mills per kilowatt-hour, but that is using very conservative estimates and, in taking fuel credit for plutonium, Mr. Holifield, we used what we thought was a more realistic figure of $12 dollars per gram of plutonium instead of any higher figure.

Representative HOLIFIELD. I want to compliment you on making your calculations on the $12 value because, as I understand it, the British used that figure in computing their cost.

Mr. SPORN. Yes; but, of course, the British in their cost do not have many of the costs that we have.

Representative HOLIFIELD. That is right.

Mr. SPORN. They do not put in taxes.

Representative VAN ZANDT. It is not a matter of bookkeeping, then?

Mr. SPORN. Yes, sir; entirely different and they have totally different setups regarding labor costs, which are very important to us.

Representative DURHAM. Mr. Clapp, on what type of contract do you operate today for fuel?

Mr. CLAPP. At the present time my particular company has a 3-year contract with an independent oil refinery for the supply of fuel.

So far we have not been able to get anyone else interested in a contract beyond a 1-year period other than this independent we are now dealing with.

Representative DURHAM. One-year period at a time?

Mr. CLAPP. Yes.

Representative VAN ZANDT. Mr. Clapp, this doubling of your load every 5 years, is it attributed to the expansion of your population in Florida, or is it industrywide?

Mr. CLAPP. It, of course, primarily is population increase and also increased use per customer, greater use of electric appliances naturally, of course, and then more recently industry has played a big part in the increase.

Representative HOLIFIELD. Dr. Zinn, do you expect from this experiment an appreciable increase in research and developmnet knowledge? Does this explore, in other words, new fields, or is this more or less covering some of the fields that have already been covered?

Mr. ZINN. No, sir; some new ground must be turned in order to make this reactor design into a reality. This new ground concerns materials specifically in connection with the pressure tubes which are nowhere used at the present time, although a number of groups are interested in them, notably the Canadians.

And also new materials in connection with the fuel, since the temperature we are talking about is higher for the fuel than any that has been used so far in the reactor or in any of the contemplated reactors.

So the research and development to be done is specific, it will yield important results.

Representative HOLIFIELD. Are there any further questions?

Representative DURHAM. Mr. Chairman, the meeting in the morning will be in F–39. It will be a public hearing on the matter of this underground explosion and detection error.

Representative HOLIFIELD. Thank you, gentlemen. We will excuse you at this time, and will ask the Commission to come back to the stand.

Now we will explore briefly the request in the bill for $35 million for destroyer reactor plant.

(The balance of this day's hearing has been printed separately under the title "Authorizing Legislation for Destroyer Reactor Plant," dated March 14, 1958.)

(Whereupon at 11:40 a. m. Friday, March 14, 1958, the subcommittee adjourned to convene at 10 a. m., Saturday, March 22, 1958.)

REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

SATURDAY, MARCH 22, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to notice, at 10 a. m., in the committee room, the Capitol, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield (chairman of the subcommittee), Durham (chairman of the full committee), Price, Van Zandt, Aspinall, Hosmer; Senators Anderson and Dworshak.

Present also: James T. Ramey, executive director, and David R. Toll, staff counsel, Joint Committee on Atomic Energy.

Representative HOLIFIELD. The subcommittee will come to order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning to receive testimony concerning proposed arrangement No. 58–111–6, between the Atomic Energy Commission and the Pennsylvania Power & Light Co. and Westinghouse Electric Corp.

By letter dated February 24, 1958, signed by AEC Chairman Strauss, the Commission forwarded program justification data concerning the proposed arrangement, and also requested waiver of the 45-day period provided by section 111b of Public Law 85–162. Without objection, I would like to insert in the record at this point a copy of the letter dated February 24, 1958, from Mr. Strauss to Mr. Durham, and a copy of the program justification data.

(The letter and program justification referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., February 24, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy.

DEAR MR. DURHAM: This letter is to inform you that the Atomic Energy Commission has determined that the proposal for a demonstration nuclear powerplant submitted by the Pennsylvania Power & Light Co. and Westinghouse Electric Corp. under the third invitation of the power demonstration reactor program constitutes an acceptable basis for contract negotiations, and that a basis for agreement on this project has been reached by the parties.

The proposal, as you may recall, covers the research and development, design, construction, and operation of a single-region slurry homogeneous type reactor in the size range of 70 to 150 megawatts on the system of the Pennsylvania Power & Light Co. The companies estimate completion of the plant by about December 31, 1963. The proposal contemplates AEC assistance of about $7 million for preconstruction research and development, $18 million for additional research and development to be performed during the construction and operating phase, and the waiver of U–235 and U–233 use charges, presently estimated

at slightly more than $4 million. The companies state they have already borne $5.5 million of research and development costs, and will bear about $57 million capital costs, and $16 million excess operating costs.

We would expect to utilize presently available funds for the initial $7 million AEC assistance, and to request the remaining AEC requirements as part of our fiscal year 1960 appropriation request.

The research and development contemplated under this proposal will be coordinated with and will complement the work on the homogeneous reactor type which is being carried on at Oak Ridge National Laboratory. Similar coordination with ORNL has been carried out by the proposers during previous work on the project.

Periodic technical reviews will be conducted of the work at Westinghouse and at ORNL, including reviews of the performance of the HRE_2 which recently went into operation. In the event that such reviews result in adverse findings regarding technical feasibility or promise of the reactor proposed by PPL, the contract would be terminated under the provisions described in section 9 of the attached program justification data.

In accordance with the requirements of section 111, Public Law 162, 85th Congress, there is filed with you, herewith, the basis for the proposed cooperative arrangement with the companies.

In order that research and development work on this promising reactor type may proceed as rapidly as possible, you are requested to waive the requirement of section 111, Public Law 162, that the basis for the proposed arrangement lie before your committee for a 45-day period.

Faithfully yours,

LEWIS L. STRAUSS, *Chairman.*

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58–111–6

A. *Name of contractors*

1. *Prime contractors.*—Pennsylvania Power & Light Co., Allentown, Pa., and Westinghouse Electric Corp., Pittsburgh, Pa.

B. *Description of proposed project*

1. *Objective.*—The objectives of the proposed project are to bring new resources into the development of nuclear power technology, to advance the art, and to accelerate the time when economically competitive nuclear power is achieved. These objectives are to be achieved by a proposed arrangement which, on the terms given below, is directed to the construction and operation of a large-scale nuclear powerplant of the single-region slurry homogeneous type, designed to produce 70,000 to 150,000 net electric kilowatts of energy and to be operated for 5 years as part of the Pennsylvania Power & Light Co.'s system.

2. *Location.*—The proposed plant will be located within the chartered territory of the Pennsylvania Power & Light Co. in central eastern Pennsylvania.

3. *Technical aspects (data are approximate and are based on a plant of 150 electrical megawatts).*—

Heat output: 550 megawatts.

Electrical output: 150 megawatts.

Type of fuel: Slurry of thorium and uranium oxides in heavy water.

Amount of fuel loading (active section): 40,800 liters at a solids concentration of 292 grams per kilogram of D_2O.

Enrichment percent U–235: Full.

Moderator: The fuel slurry.

Coolant: The fuel slurry.

Reactor outlet temperature: 580° F.

Reactor pressure: 2000 pounds per square inch, absolute.

Steam conditions: 400 pounds per square inch, absolute, 445° F, 2 million pounds per hour.

Byproduct utilization: Not yet determined.

4. *Estimated date of completion.*—December 1963.

C. Estimates of cost:

[In thousands—based on a plant of 150 electrical megawatts]

Element of cost	Allocation of estimated costs [1]	
	AEC	Pennsylvania Power & Light-Westinghouse
1. Preconstruction research and development:		
(a) Prepoposal phase (1955–57)		$5,500
(b) Phase I (1958–59)	[2] $7,000	
(c) Phase II (1960 to completion of construction)	[3] 15,290	
2. Design, fabrication and construction:		
(a) Land, building and structures		14,100
(b) Reactor and related facilities		27,750
(c) Conventional generating facilities		15,200
3. Postconstruction costs:		
(a) Phase II research and development	[2] 3,040	
(b) Excess operating costs		[4] 15,825
4. Waiver of fuel use charges	[5] 4,011	
5. Total	[6] 29,341	78,375

[1] This allocation is subject to pars. D.4 and D.10.
[2] This amount is a maximum. It does not include ORNL's share of joint irradiation program costs applicable to this period.
[3] These 2 amounts taken together constitute a maximum.
[4] Assumes U–233 production credits and U–235 burn-up charges are made simultaneously.
[5] Subject to adjustment upward or downward for changes in AEC prices and use charges.
[6] Includes fixed fee to Westinghouse for engineering services.

D. General features of proposed arrangements

The proposed arrangement consists of two parts. Phase I, consisting of a preconstruction research and development program scheduled for the period 1958–59, is firm. The phase II program, consisting of further research and development, construction, and 5 years' operation, will be undertaken under a supplemental agreement, upon a determination of the technical feasibility of the plant and upon the proposers being willing to proceed with such construction and operation of the plant. If upon determination of technical feasibility the proposers are not willing to proceed with such construction and operation of the plant on the terms stated below, the proposers will repay in full all funds paid by AEC under phase I. The undertakings of the proposers under the contract will be both joint and several.

1. *Site.*—The site for the nuclear powerplant will be selected and provided by Pennsylvania Power & Light Co. and be subject to approval by AEC.

2. *Construction.*—The nuclear plant will be constructed by the proposers, including possible associates, following the decision to proceed with its design and construction.

3. *Operation.*—The Pennsylvania Power & Light Co. will operate the plant for 5 years as part of its power system.

4. *Financial assistance.*—The phase I program, scheduled for the calendar years 1958 and 1959, is designed to yield the further information necessary to permit the parties to make a prudent decision on construction of the plant. The AEC assistance will cover the period starting January 1, 1958, and will total a maximum of $7 million. At the end of phase I, AEC and proposers will make a joint determination as to the technical feasibility of the proposed powerplant. If the proposed plant is determined to be technically feasible, proposers will either proceed with phase II of the proposal calling for construction of the plant, or proposers will repay in full all the funds paid by AEC under phase I. If the proposed plant is jointly determined to be technically infeasible, the program will terminate. In this event, there will be no repayment to AEC of the funds paid by it, and the result will be that proposers will have paid for the 1955–57 research program and AEC will have paid for the 1958–59 program. If there is not mutual agreement as to technical feasibility or infeasibility as between AEC and proposers, then AEC's determination shall be controlling.

During the phase II program, scheduled to run from 1960 to the end of the fifth year of operation of the plant, AEC will provide the additional research and development necessary to construct the plant and assist in the performance of specified research and development programs during plant operation. The base AEC assistance for phase II will consist of—

(*a*) research and development not to exceed $18.33 million, including about $15.3 million through the end of construction and $3 million during the operating period; and

(*b*) waiver of use charges on the special nuclear material for the initial 5-year operating period, valued at $4.011 million, subject to adjustment upward or downward for changes from current AEC use charges and prices.

The $18.33 million will be reduced to offset additional assistance, if any, which AEC might agree to provide in connection with an extension of phase I.

Other assistance, not presently provided for by the third round of the power demonstration reactor program, including, among other items, a loan of the initial plant loading of heavy water and the waiver of the 5-year use charge thereon, also may be requested by the proposers in connection with the supplemental agreement covering phase II, the principal terms of which shall be set forth in the definitive contract, subject to any changes which may be acceptable to AEC.

5. *Title.*—Pennsylvania Power & Light Co. will be the sole owner of the nuclear powerplant.

6. *Term.*—The term of the contract will extend until the expiration of 5 years after the date the plant first produces power, unless the contract is terminated earlier under the provisions discussed in items 4 and 9.

7. *Indemnity.*—As a licensee of the Commission, the proposers will be subject to the provisions of Public Law 256, 85th Congress.

8. *Option to purchase.*—AEC will have the right to purchase the nuclear facilities at any time after foundation pouring begins if the proposers fail to continue the project for any reason other than termination by (*a*) mutual agreement, or (*b*) proposers' inability to obtain necessary licenses, regulatory agency approvals, or adequate liability insurance coverage, or (*c*) mutual reversal of the previous plant feasibility determination.

9. *Termination.*—In addition to the automatic termination provisions discussed in section 4, AEC and proposers may, by mutual agreement, terminate the phase I program at any time if considerations of technical infeasibility make such action appropriate. AEC may also terminate for the convenience of the Government at any time during phase I. In either of these cases, responsibility for costs shall be on the same basis as in the case where the program is terminated at the end of phase I by reason of a joint determination of technical infeasibility.

Proposers may at any time, without the concurrence of AEC, terminate the phase I program if in their sole discretion it is not desirable to continue for any reason. If proposers should so terminate the program, they will repay to AEC all funds paid by it up to any such date of termination.

In the event that AEC fails to accept within a reasonable time a proposal for phase II which requests only the base phase II assistance, or is unable for any reason to commit the necessary funds, then the proposers may terminate the project without any obligation of repayment to AEC for funds paid under phase I.

Phase II may be terminated by mutual agreement, or by the proposers' inability to obtain necessary licenses, regulatory agency approvals, or adequate liability insurance coverage, or by a mutual reversal of the previous plant feasibility determination. There will be no repayment of funds in any such case.

10. *Alternative or modified proposal.*—In view of the many uncertainties that exist, proposers will not be precluded from submitting nor AEC from accepting any alternative or modified proposal on a basis acceptable to AEC and consistent with any existing or new legislative or administrative policies which may then be effective.

11. *Patents.*—AEC will receive all rights to inventions arising out of AEC-supported research and development work, except that Westinghouse will receive a nonexclusive, irrevocable royalty-free license; Westinghouse also will receive outfield rights on inventions in areas where it has an established patent position. If, however, the cost of such research and development program is finally paid for by the proposers, then AEC shall receive only an irrevocable, royalty free, nonexclusive license under any inventions which arose during AEC's participation in the program.

12. *Licenses.*—The proposers will undertake to obtain all necessary licenses from AEC, and such other necessary approvals from Federal, State, and local

regulatory agencies as are required to permit the construction and operation of the plant and the sale or use of the energy produced therein.

13. *Information and records.*—The proposers will keep available for AEC inspection and study, and require their subcontractors to keep such records of technical, economic, and financial data as will enable AEC to carry out the purposes of the power demonstration program. The proposers will also supply, and will require their subcontractors to supply, to AEC for such purposes such data as AEC may reasonably request.

Representative HOLIFIELD. By another letter also dated February 24, 1958, the Commission forwarded a memorandum from Commissioner Graham indicating that Mr. Graham had voted in the negative when this proposed arrangement was considered by the Commission. Without objection, I would like to insert in the record at this point the second letter dated February 24, 1958, from Mr. Strauss to Mr. Durham, together with a memorandum dated February 24, 1958, from Commissioner Graham to Mr. W. B. McCool, secretary of the Commission.

(The letter referred to follows. The memorandum appears on pp. 60–61.)

UNITED STATES ATOMIC ENERGY COMMISSION,
February 24, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
The Capitol, Washington, D. C.

DEAR MR. DURHAM: I send you this letter to accompany my letter of even date on the subject of the Commission's action on the proposal submitted by the Pennsylvania Power & Light Co. and the Westinghouse Electric Corp.

Three of the four Commissioners who attended the meeting at which action was taken (Messrs. Libby, Vance, and Floberg) voted to proceed now with the proposal. Commissioner Graham's position, essentially, was that the action was not timely, as reflected in his memorandum on the subject which is attached and which I send you with his consent.

Had it been possible for me to attend the meeting, I should have voted for approval but am not so recorded.

Faithfully yours,

LEWIS L. STRAUSS.

Representative HOLIFIELD. The representatives of the Atomic Energy Commission this morning are Mr. K. E. Fields, General Manager, and Mr. W. K. Davis, Director of the Division of Reactor Development.

Also present in the room, in response to invitation sent by the Joint Committee, are representatives of the Pennsylvania Power & Light Co. and Westinghouse Electric Corp., who may desire to testify or answer questions later this morning.

We are very glad to have you here this morning, Mr. Fields and Mr. Davis. Will you please proceed?

Mr. FIELDS. Mr. Chairman, Commissioner Graham and Commissioner Vance are likewise here, I believe at your invitation.

Representative HOLIFIELD. Yes. Excuse me for not mentioning that.

STATEMENTS OF K. E. FIELDS, GENERAL MANAGER; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; EDWARD DIAMOND, GENERAL COUNSEL; HAROLD S. VANCE, COMMISSIONER, AND JOHN S. GRAHAM, COMMISSIONER, UNITED STATES ATOMIC ENERGY COMMISSION

Mr. FIELDS. Mr. Chairman, we have provided to the committee copies of my statement and Mr. Davis' statement. You have copies of the memorandum that you spoke of from Commissioner Graham.

Mr. Chairman and members of the committee, we are here today to discuss with you the proposal for a nuclear power project submitted by the Pennsylvania Power & Light Co. and Westinghouse Electric Corp. under the third round of the Commission's power demonstration reactor program. There was transmitted to your committee on February 24, 1958, the program justification data, No. 58–111–6, which sets forth the basis for the proposed cooperative arrangement under the provisions of section 111, Public Law 85–162.

The Commission has determined that this proposal constitutes an acceptable basis for contract negotiations. It contemplates the research and development, design, construction, and operation of a single-region slurry homogeneous-type reactor in the size range of 70 to 150 megawatts on the system of the Pennsylvania Power & Light Co. Completion of the plant is estimated by about December 31, 1963.

The proposal provides for AEC assistance in preconstruction research and development amounting to $7 million. On their part, the companies state they have already done research and development to the extent of about $5.5 million and will, if the project moves forward, incur capital costs of about $57 million and some $16 million in excess operating costs, provided the Atomic Energy Commission contributes additional amounts for research and development to be performed during the construction and operating phase, not to exceed $18,330,000 and waives use charges on U–235 and U–233 up to $4,011,000.

The $7 million of AEC assistance for the preconstruction research and development would constitute phase I of the program. Phase II would cover the research and development to be performed during the construction and operating periods. Prior to initiating work under phase II, the Commission and the companies would make a joint determination as to the technical feasibility of the proposed powerplant based on the research and developmet work previously accomplished. If the plant is determined to be technically feasible, the companies will either proceed with phase II, providing for construction of the plant, or they will pay in full the $7 million expended by the Commission under phase I. In the event that the plant is jointly determined to be infeasible, the program will terminate in which case there would be no payment to the AEC of the $7 million previously expended, with the result that the companies will have paid for the research undertaken by them during 1955 through 1957 and the Commission will have paid for the research program during calendar 1958 and 1959. If there is not mutual agreement on the feasibility problem, the Commission's determination will be controlling.

Obviously the Commission would have to request an increase in the amount projected for the third round under the currently authorized program for cooperative arrangements, if this second phase were to proceed. Additionally, of course, the basis of the arrangement for such second phase would be submitted at a later date to this committee under the current authorization requirements.

Here I would like to make an important interpolation, sir. Under the current authorization requirements, if any of the essential features of it are changed, the phase I amount of $7 million will be provided from the third round availability under the current authorization with our proposed 1959 authorization bill providing for the phase II amount.

Representative HOLIFIELD. The Chair will remark at this time that there may be some legal problems involved there which the staff has not had time to check as yet.

Mr. FIELDS. I understand, Mr. Chairman. This is our present interpretation of it; that if there are no essential features, if you do proceed with this, and provided the 1959 authorization we request is passed, then the law would not require resubmission of it. Obviously we are going to report fully on it before we would proceed with phase II, and depending on the committee's wishes here whatever course you feel is appropriate would be followed.

Mr. RAMEY. Do you have a legal opinion on that interpretation that the committee can have?

Mr. DIAMOND. We have no written opinion, Mr. Ramey.

Mr. FIELDS. We could provide one.

Mr. RAMEY. Could you provide one for the record?

Mr. FIELDS. We will do so; yes, sir. Shall I proceed, Mr. Chairman?

Representative HOLIFIELD. Yes.

Mr. FIELDS. Work on the preconstruction research and development phase previously initiated by the companies is continuing at a rate approaching $300,000 per month. It is being supported by the companies with the understanding that AEC, upon execution of a contract, would reimburse costs incurred since January 1, 1958. We are requesting a waiver of the 45-day statutory waiting period of this project in order to assure maximum continuity in the conduct of the work.

Mr. Davis, Director of the Reactor Development Division, has a short statement on the technical aspects of the proposed project, at the conclusion of which, Mr. Chairman we could proceed to answer such questions as your committee might have. This contains some additional features with respect to the arrangement.

Representative HOLIFIELD. In view of the fact that this was not a unanimous opinion of the Commission, I think at this time we should accord Commissioner Graham the opportunity of placing into the record his attitude on this particular project, and then we will get into the technical phase of it.

Mr. Graham, would you proceed at this time?

Mr. GRAHAM. Thank you, Mr. Chairman.

I have with me, sir, a photostatic copy of the original of the memorandum which was submitted for the Commission's files and a copy of which, as you have indicated, Mr. Chairman, was forwarded by

Chairman Strauss to Chairman Durham. This is dated February 24, 1958, memorandum for W. B. McCool, Secretary of the Commission, from me as a Commissioner, entitled, "Pennsylvania Power and Light/Westinghouse proposal, AEC No. 777/61."

"This proposal was approved by the Commission at its meeting on Monday, February 7, 1958, on a vote of 3 to 1, Messrs. Floberg, Libby, and Vance—if I may interpolate I took this in alphabetical order—in the affirmative, Graham in the negative. You suggested that it would be appropriate to submit a memorandum of my views.

"This matter had been before the Commission previously at its meeting on February 5, 1958. I then expressed some doubt about it. Dr. Libby at that time thought that the proposal needed another review from the technical standpoint. I mention the two meetings because I am not sure that what I said during the first meeting was fully repeated during the second. I was then and still am troubled by the proposal. It seems to me that it was predicated on several "iffy" points, which were not fully resolved in my own mind. I shall endeavor to comment on these points.

"First, questionable need for another source of work on homogeneous reactor at this time. As I understand, some of the history of this concept, the Commission was assured by Dr. Weinberg, about a year ago, that the homogeneous reactor was ready to be exploited. As a result a sentence was included in the President's message of 1958 to the effect that if an acceptable proposal for non-Federal construction of a homogeneous reactor did not materialize within a reasonable time a request would be made for Federal funds to do so. Subsequently, as I understood the chronology, corrosion problems raised a serious question as to the present feasibility of this concept. However, we now have at Oak Ridge the second homogeneous reactor which, I believe, is specifically designed to overcome the design complexities apparent in this type of reactor. (The first such reactor I am told was only to prove the validity of a physics experiment.) The second reactor went critical on December 27, 1957, and Dr. Libby reports from his visit to Oak Ridge on February 13 and 14 that it has been at authorized power for only a few days. It seems to me that it is too early to conclude that we need another contract with an outside company to pursue this same route at this time. A few months of experimental work at Oak Ridge would not in my judgment really delay this project. We also have some money being spent at Los Alamos on this same problem, although I am told that this project is not really related. I must confess I do not understand the technological differences.

"Point 2. This contract is categorized by the General Manager as an essentially research and development contract. General Fields noted that this is essentially a research and development contract in the first phase in which the AEC agrees to advance about $7.3 million. As a result of the discussion at the meeting on February 17 about the duration of this 2-year, first-phase contract, it was recognized that should complications develop the Government might not want to continue to pursue this route. Therefore, additional contract clauses were suggested so as to give the Government a right of cancellation at any time. In my opinion, this improves the contract, but it still does not overcome my doubts as to the need to move forward just at this time with an extremely complicated arrangement.

"3. This may lead to another scientific laboratory. The General Manager has observed that if it is desirable to accelerate the civilian power program, then this R. and D. contract is one method of moving ahead as a supplement to the work that is being performed in the Government laboratories. Dr. Libby recalled that when he was a member of the GAC, there was a proposal from a private company to the Commission which involved some of the same elements as does this proposal, that GAC studied the matter, it was accepted by the AEC and this resulted in a scientific undertaking which has been large in terms of scope and cost. The current proposal involving a possible $25 million in Government support has the possibility of resulting in the same sort of scientific complex and raises another doubt in my mind as to the wisdom of proceeding in this manner at this time. It would seem more preferable to me to wait until more information has been obtained from our Oak Ridge National Laboratory.

"4. The contract is complicated. The contract seems unnecessarily complicated. It is, as General Fields indicated, basically an R. and D. contract. By dividing this effort into phase I and phase II with no commitment to build a reactor until the end of phase I (during which $7.3 million of Government money would be expended), we have in my opinion complicated the matter without really gaining any worthwhile objective. The proposal contemplates that the proposer, if he so elects, may terminate this contract for any reason and refund the $7.3 million expended during phase I. If after the work is done AEC decides the concept is not technically feasible, the contractor would not be required to refund the money. My colleagues believe that it is advantageous to have the possibility of the Government being repaid the $7.3 million. I think the possibility is remote and that repayment, even though proposed by the contractor, has complications in it that persuade me that on this and other grounds we should not at this time proceed in this manner."

That is the end, sir.

Representative HOLIFIELD. Thank you. Do you have anything further to state on the matter, Mr. Commissioner?

Mr. GRAHAM. Only this, sir. We had a full and frank discussion of this matter in the Commission. We came to a disagreement which personally, sir, I think is healthy. I think it proves the value of having a five man Commission where you can sit down and discuss your problems and come out with an honest difference of opinion. I certainly don't feel badly about this, that my views did not prevail. It is a Commission decision and that is acceptable to me.

Representative HOLIFIELD. I think that is the attitude with which the committee will accept the views of any member of the Commission. As you say, it is one of the reasons why we have a five man Commission, to bring to bear upon any subject the varied backgrounds, experience and judgment of five different men. We would probably be suspicious if there was always a unanimous opinion. There is not a unanimous opinion on this committee about a lot of things.

I think in order to have the record complete at this time without objection we will insert in the record a letter from Chairman Lewis Strauss in which he indicates that although he was absent at the time that he would have voted with the majority in favor of the proposal.

(The letter referred to appears on p. 57.)

Representative HOLIFIELD. That takes care of the statements of all of the Commissioners.

Representative VAN ZANDT. Mr. Chairman, may I ask a question at this point?

Representative HOLIFIELD. I was going to ask, if the gentleman will hold his question a minute, if it would be the will of the committee at this time to hear the technical phase presented by Mr. Davis and any other representative of the technical group that might be present before the questioning of all of the Commission witnesses. What is the will of the committee? Is that satisfactory? I understand it is.

Representative VAN ZANDT. May I ask a question of Commissioner Graham before we call upon Dr. Davis?

Commissioner Graham, in your opinion, do you think that this subject-matter received thorough consideration by the Commission as a whole?

Mr. GRAHAM. Yes, sir, I think we had a good discussion on it. We had two sessions on it. We went into it with a full discussion. I am satisfied that as a Commission we had a full discussion.

Representative VAN ZANDT. And all technical information was available to the Commission during the time of the consideration?

Mr. GRAHAM. I do not know all the technical information was available, sir. There was a great batch of it. I could not answer that. That would be somebody else who would have to say whether it was all made available. The only thing I can say is that there was a considerable amout of it. Going over it, I came out where I did and I had these questions. We discussed it up and down. When the vote came I was outvoted. I don't feel badly that I was outvoted.

Representative VAN ZANDT. That is all, Mr. Chairman.

Representative PRICE. You list as your No. 1 point as there being a questionable need of another source of information that you would get from this new R. and D. contract. Does that imply that you think the project at Oak Ridge is adequate to provide, with any new phase that might come into it, the technical information that you would need in this particular project?

Mr. GRAHAM. If I understand correctly the import of your question, Mr. Price, it is whether or not the Oak Ridge work in this corrosion problem would reveal any information that would be helpful to us.

Representative PRICE. Yes.

Mr. GRAHAM. I thought that would be very helpful to us, sir.

Representative PRICE. Not only that, but I had always thought, at least, that the Pennsylvania project more or less depended upon the information gained in the Oak Ridge project on the homogeneous reactor, and I thought that it would provide most of the technical information needed in the project.

Mr. GRAHAM. I am not sure I can answer all of the work that has been done by Oak Ridge.

Representative PRICE. This was my previous understanding which may not be correct. That is the point I would like to have cleared up. I would like to know whether you felt the same way about that. You say the questionable need of another source. What is the present source of information for the buildup of this particular project?

Mr. GRAHAM. It is my understanding, sir, that Oak Ridge has led in this type of reactor for many years. I believe it is correct that the proponents have worked closely with Oak Ridge.

Representative PRICE. That was my understanding.

Mr. GRAHAM. This is my understanding.

Representative PRICE. Do you think then that if you go into this new program you would be more or less duplicating the project at Oak Ridge? Maybe that will be developed as the technical information is coming along.

Mr. GRAHAM. I think that is the best way.

Representative PRICE. I will defer until we do get the technical information.

Mr. GRAHAM. Thank you, sir.

Representative HOLIFIELD. Mr. Davis, will you proceed? May I ask at this time if Mr. Charpie is here from Oak Ridge, or is there any representative from Oak Ridge?

Mr. DAVIS. No, they have all returned to Oak Ridge or gone elsewhere.

Representative HOLIFIELD. You are prepared to answer the technical questions?

Mr. DAVIS. Yes. I have here some information on the progress that has been made with the homogeneous reactor No. 2 if you would like me to include that at the end of the statement.

Representative HOLIFIELD. For the committee's information, the Chair thought it might be helpful to have Dr. Weinberg here, but he was en route to Oak Ridge and it was inconvenient to get him back here this morning. So I asked General Fields to have Mr. Davis contact Oak Ridge for any additional technical information that he wants to present, and if there is any additional information needed after Mr. Davis' presentation which could not be obtained from him or from the Westinghouse people, we will, at the will of the committee, call Dr. Weinberg before us at a later date.

Senator ANDERSON. May I ask General Fields, is there any policy about this business of letting witnesses who might give direct information get away? Dr. Weinberg's testimony might be important. I ran through the testimony on this seismic report the other day. Dick Elliott, who had issued the report, was here and in the room and I don't believe he was ever put on the stand, the one man who could probably testify most accurately. Dr. Weinberg can give us real help on the points that Mr. Graham raises and he goes back to Oak Ridge last night. Was it important that he get there one day earlier?

Mr. FIELDS. Senator Anderson, he had already left when the question had risen with respect to him.

Representative HOLIFIELD. That is true.

Senator ANDERSON. I wonder why the Commission sends him back?

Mr. FIELDS. We did not send him back.

Senator ANDERSON. I don't like a Saturday hearing but I am down here. Why couldn't he have been here?

Mr. FIELDS. He could have been here, I am sure, had it been considered in time to reach him. He had already left when the question arose. There is no policy in this regard.

Senator ANDERSON. Isn't he well posted on this particular problem?

Mr. FIELDS. He is on the homogeneous reactor at Oak Ridge, yes, and on homogeneous reactors generally.

Senator ANDERSON. Is he posted on the Pennsylvania Power & Light transaction?

Mr. FIELDS. I am not sure he is as well posted as other people.

Senator ANDERSON. When I heard him testify, I thought he was very well posted on it.

Mr. FIELDS. I am sure he knows a great deal about it. He is not here only because the consideration of having him here came up after he had departed, sir. I assure you of that.

Senator ANDERSON. How did he happen to come in here?

Mr. FIELDS. He was here on a conference that was convened by the Division of Reactor Development with respect to a report being prepared to be submitted on the 1st of April, sir.

Representative HOLIFIELD. The Chair was probably lax in not thinking of asking Dr. Weinberg to be here but I did not think of it until about 5 o'clock yesterday afternoon, and when I called he was en route to Princeton.

Mr. FIELDS. I would only like to say further that in our thinking of this, we felt that we would be able to provide the committee with the pertinent information with respect to the homogeneous reactor experiment as it would bear on this particular proposal before you today. Perhaps it is an oversight.

Representative HOLIFIELD. I suggest that we let Mr. Davis proceed at this time.

Mr. DAVIS. Thank you, Mr. Chairman.

The Pennsylvania Power & Light reactor concept represents a productive offshoot of the main line aqueous homogeneous reactor development work which the Commission has sponsored during the past few years. As we have stressed in the past, the homogeneous reactor is really a family rather than a single concept.

The work at our ORNL has been pointed toward the development of a two-region breeder reactor comprised of a central core region of dilute uranyl sulfate solution in heavy water and an outer region of concentrated thorium slurry. The conversion ratio of such a system is expected to be somewhat in excess of 1.0. If a major nuclear power industry is to be developed in this country, or in the world for that matter, it is essential that reactors capable of breeding be developed. I am thinking in terms of maximizing the utilization of available fuel reserves which will ultimately have a significant effect on power economics. The work at Oak Ridge is therefore slanted toward what might be called the "ultimate" in aqueous homogeneous reactors.

The proposed Pennsylvania Power & Light reactor emphasizes the shorter range view. It is a single region unit which is loaded with a mixture of thorium and uranium in dilute slurry form. Such a reactor inherently has a lower conversion ratio, and a practical engineering system may not be capable of breeding. Based on current demands for nuclear materials and current prices, no serious economic penalty results and, as a matter of fact, in the long term the nuclear power complex will probably accommodate both breeders and converters. In adopting the single region slurry approach the Pennsylvania Power & Light group has selected a system which appears to be technologically closer at hand than the two region system. In so doing they can contemplate the construction of a fairly large demon-

stration reactor on a relatively short time scale. Construction of a demonstration reactor based on the homogeneous concept as early as possible will make a major contribution to the general field of circulating fuel reactors.

Quite independent of the details of reactor type, that is whether it is 1 region or 2 or whether it is an aqueous or metallic system, the feasibility or remote maintenance in circulating fuel reactors must be demonstrated in a large-scale operating system. If the Pennsylvania Power & Light work leads to a definitive answer to this one question, it would be well worth the efforts and money of the AEC and the participating companies involved.

I mentioned that the Pennsylvania Power & Light approach was technologically closer at hand than the two region system—a few words of explanation would be of interest. The two region system is characterized by a highly corrosive circulating fuel, a very heavy non-Newtonian slurry and a difficult material problem where the two regions converge at the reactor core liner. This is the separator between the outer and inner core. In the past 12 months at ORNL we have made significant strides in solving these basic problems attendant to the 2 region system. We expect ultimately to find satisfactory answers to these problems but not for a number of years. In the single region slurry system, the solvent is water and from the corrosion standpoint one might expect materials to behave not too differently than in any water system. I must qualify this in one respect. We are not yet sure what effect fission products will have on the corrosiveness or erosiveness of the slurry. The slurry being relatively light compared to the blanket of the two region system, should be easier to control and probably less erosive in nature.

These differences notwithstanding, there are four major problem areas on which Pennsylvania Power & Light has requested AEC assistance and on which we feel such assistance is warranted. These are:

1. Effects of radiation on properties of slurries.
2. The distribution of slurry flow in the reactor vessel.
3. Development of remote maintenance procedures.
4. Fuel reprocessing.

It is pertinent to identity the role of the HRE No. 2 with respect to these two approaches. The HRE No. 2 is essentially a small size mockup of the central region circuit of the ultimate two region homogeneous reactor. It will give much valuable data for the two region breeder and for homogeneous systems in general; however, it is not a direct reactor experiment for the Pennsylvania Power & Light type of reactor.

Another reactor of the homogeneous type is the single region burner concept which was proposed by the Wolverine Electric Cooperative under the second round demonstration program. This type is similar in many ways to the central core of HRE No. 2 in that the fuel is highly enriched uranyl sulfate and the moderator is heavy water. Corrosion and maintenance problems would be similar in kind but more severe than those of HRE No. 2 and there would be no production of plutonium.

I should also like to comment briefly on several contractual features of the proposed arrangement with Pennsylvania Power &

Light-Westinghouse. These features arise out of the present status of homogeneous reactor technology. As the companies stated in their proposal, while research work to date indicates that there are no insurmountable technical difficulties, approximately 2 more years of research and development work will be necessary before a prudent decision can be made as to construction of the proposed plant.

Accordingly, the proposed arrangement consists of two parts. Part I, consisting of a preconstruction research and development program scheduled for the period 1958–59, is firm. The phase II program, consisting of further research and development, construction, and 5 years' operation, would be undertaken under a supplemental agreement, upon a determination of the technical feasibility of the plant, and upon the proposers being willing to proceed with construction and operation of the plant. The provisions governing the technical feasibility determination and the companies' obligation to proceed thereunder or to repay AEC assistance received, we have already outlined to you. The principal contractual terms of the supplemental agreement will be set forth in the definitive phase I contract, subject to any changes which may be acceptable to AEC.

Assuming that the plant is technically feasible and that the companies decide to proceed with construction and operation of the plant, they will so notify the Commission and will request certain specified base assistance from the Commission for phase II of the program. This assistance will include support by the AEC, in an amount not to exceed $18,330,000, of additional research and development during the construction phase, and of research and development programs during the first 5 years of plant operation. The Research and Development assistance provided by AEC during the operating period will be for specific work to be described in the contract, and will not be used to defray operation and maintenance costs. The specified base assistance will also include a waiver of fuel-use charges for the initial 5-year operating period, presently valued at approximately $4 million.

The Commission is not obligated to proceed with phase II of the program, and may reject the companies' request for assistance. In that event, however, the companies would not be obligated either to proceed with the construction of the plant or to refund payments made by the Commission during phase I.

In addition to the specified base assistance just described, the proposed arrangement contemplates that the companies may also request other assistance during phase II not presently provided for by the third round of power demonstration reactor program, including, among other items, a loan of the initial plant loading of heavy water and the waiver of the 5-year use charge thereon. The Commission may accept or reject such additional request in its sole discretion, although, in the case of the waiver of heavy-water use charges, it should be noted that the Commission would be authorized to provide this assistance if Congress enacts the amendment to the 1958 authorization act which the Commission recently proposed. If the Commission decides to reject the companies' request for additional assistance, the companies must either proceed with construction and operation of the plant on the basis of the specified base assistance previously described or refund all moneys paid by the Commission under phase I.

The Commission and the companies have also agreed that the companies will not be precluded from submitting, nor AEC from accepting, any alternative or modified proposal covering phase II work on a basis acceptable to AEC and consistent with any new or existing legislation or administrative policy which may then be effective. The companies requested this provision in the arrangement as recognition of the current technical uncertainties concerning the homogeneous reactor and the fact that developments during the next 2 years might warrant adjustment in their phase II proposal. AEC will, of course, be under no obligation to accept any such modified or alternative proposal, and rejection of such a proposal by AEC would not excuse the companies from any of their obligations under the present proposed arrangement.

An additional recognition of the technical uncertainties presently associated with the development of homogeneous reactors, both the Commission and the companies have reserved the right to terminate the arrangement at any time during the phase I work. If the companies terminate the arrangement, they must refund all moneys paid by the AEC during phase I. If the Commission elects to terminate the arrangement, or if the arrangement is terminated by mutual consent, there will be no repayment of the AEC funds.

Additional details relating to these and other features of the proposed arrangement, such as patents and examination of records, are contained in the program justification data which you have before you. Also included in the program justification data is a table summarizing the respective financial contributions of AEC and the companies to the project. The data are based on present estimates as to the cost of constructing and operating a 150,000-kilowatt plant and assume that AEC provides only the specified base assistance to the phase II work.

I should be happy to attempt to answer any questions you may have on these matters.

Representative HOLIFIELD. Members of the committee, we are now ready for questions.

Senator ANDERSON. Would you tell me where, in their proposal, they state—I am quoting from page 4—that approximately 2 more years of research and development will be necessary before a prudent decision can be made as to the construction of the proposed plant? I see where they ask for 2 more years of research. But where in their proposal do they clearly point this out?

Mr. DAVIS. In the proposal as we received it from them, or in the data sheet, Senator?

Senator ANDERSON. What page would I find this on? This says as the company stated in their proposal. I am merely trying to find it.

Representative HOLIFIELD. Page 3, item 4.

Mr. DAVIS. I have a copy of the letter here which is dated January 15, 1958, signed jointly by Mr. Busby, president of Pennsylvania Power & Light Co., and Mr. Weaver, of the Westinghouse Corp., who are both here today.

Senator ANDERSON. What page is that on?

Mr. DAVIS. I was quoting from a letter here, sir.

Representative VAN ZANDT. I notice Mr. Busby is ready to answer the question.

Senator ANDERSON. I would be happy to have the witness answer, if he could.

Mr. BUSBY. This is the progress report that we submitted to the committee during the section 202 hearings. It is not the proposal. We had previously submitted the proposal, which is this large volume, to the committee in December, when it was filed with the AEC.

Senator ANDERSON. Can I have what the company said on this, because the company said other things about this at various times, and I want to know what they said.

Mr. DAVIS. Senator, I was about to quote you from this letter from Mr. Busby and Mr. Weaver, dated January 15, 1958. I am quoting now from the second paragraph of the letter:

> While no insuperable technical obstacles have arisen, many important questions and problems remain unsolved. More knowledge about this advanced reactor type is plainly needed. Our conclusion is that 2 years of further research and development are necessary before a prudent decision can be made as to construction of a large-scale nuclear powerplant of this type.

Senator ANDERSON. That is 2 years from January 15, 1958.

Mr. DAVIS. That is the way I would interpret it, sir.

Senator ANDERSON. On page 5, you list $18,330,000 of additional research and development program during the first 5 years of plant operation. I notice in this memorandum of Commission Graham that he refers, on the top of page 2, to $7.3 million. Will you relate one to the other? Is this only a part of the total bill, the $7.3 million, and the total bill is $18 million plus some additional items?

Mr. DAVIS. The phase I work which, is the 2 years of research and development which would precede phase II and the design and construction of the plant, is the $7 million item. Accompanying the design and construction of the plant would be an $18 million research and development—I am sorry—the research and development which would accompany the design and construction of the plant would start in 2 years, and would extend into 5 years of operation altogether, and that would be the $18 million item. That is in addition to the $7 million.

Senator ANDERSON. It is in addition to.

Mr. DAVIS. Yes.

Senator ANDERSON. It is not included in there?

Mr. DAVIS. That is right.

Senator ANDERSON. The AEC will put in $7.3 million for 2 years work and after that is done and if the company makes a prudent decision to go ahead, the AEC would make $18 million more available.

Mr. DAVIS. That is correct.

Senator ANDERSON. That research and development assistance will be for specific work and the specified base assistance will include a waiver of use charge of $4 million.

Mr. DAVIS. That is correct.

Senator ANDERSON. Is that in the $18 million?

Mr. DAVIS. No, sir.

Senator ANDERSON. That is $4 million more, then?

Mr. DAVIS. Yes, sir.

Senator ANDERSON. On top of that it says in addition to the specified base assistance at the bottom of page 5, the proposed arrangement contemplates that the company will request other assistance.

Mr. DAVIS. The particular item that I mentioned in my summary was the waiver of the use charge on heavy water which we estimate at $950,000 for the total period.

Senator ANDERSON. That says included but not limited to. Is that the way we should read it?

Mr. DAVIS. Yes. These are things which they may propose to the Commission but which the Commission is not under any obligation to accept.

Senator ANDERSON. If you let a company spend its millions and they warn you in advance what they need and you go ahead with their proposal, you are certainly morally obligated, if not legally obligated to proceed. Nobody would think that they would not go ahead. What is this heavy-water charge that you mention there? A loan of the initial plant loading of heavy water and the waiver of 5 years use charges thereon.

Mr. DAVIS. $950,000 is our estimate.

Senator ANDERSON. How much more is there which you now contemplate?

Mr. DAVIS. I don't now contemplate anything additional.

Senator ANDERSON. Were you present when Pennsylvania Power & Light testified in the 1956 hearings when their main purpose in life was to destroy the Gore-Holifield bill?

Mr. DAVIS. I don't believe so.

Senator ANDERSON. At that time on page 49 of those printed hearings, the Atomic Energy Commission, by its Chairman—no, this is your statement, Mr. Davis,—page 41, your statement started, and you put on page 49 this paragraph:

> The Pennsylvania Power & Light Co. has announced plans to build a plant of about 150,000 kilowatts electrical capacity using a homogeneous reactor with Westinghouse Electric Co. doing the development work. A firm decision to proceed will not be reached until 1958.

I pause there and ask if the date is now 1960?

Mr. DAVIS. That is correct.

Senator ANDERSON. We went into the data to show that we didn't need any public development in 1958.

> Completion is expected in 1962.

If a firm decision is reached in 1960, would you think that completion would be reached in 1962?

Mr. DAVIS. The present scheduled, if I recall correctly, is for the end of 1963.

Senator ANDERSON. This is an interesting sentence to me:

> No assistance from AEC has been requested, although the AEC's extensive program in aqueous homogeneous reactors is contributing knowledge of substantial benefit to this project.

Do I understand that these $7,300,000, this $18,330,000, this $4 million and this $950,000 is not to be regarded as assistance?

Mr. DAVIS. It is very definitely assistance, sir.

Senator ANDERSON. How do you read that in connection with this sentence that no assistance has been requested? Did they change their program a little?

Mr. DAVIS. At that time they did not request any assistance.

Senator ANDERSON. I am not sure they did not. I am not trying to indict you as being dishonest because I know you are an honest individual. I do not want the question to leave that inference. At the time as far as you know to the best of your knowledge and all representations that Pennsylvania Power & Light made on the Gore-Holifield bill, they did assure you that no assistance would be requested?

Mr. DAVIS. At that time I think, if I can recall the situation, we were discussing with them the nature of their project which they had started somewhat earlier. They were hopeful at that time that they could obtain the funds to carry out the project without specific government assistance. Having looked into this and having made very considerable efforts in this direction, they finally came to us and requested assistance of the type that is described here. This has evolved over the period of time and is not a sudden decision. It has happened since that period.

Senator ANDERSON. When we had our hearings on May 2, 9, 10, and 31 in 1955, Dr. Libby was testifying. I think I can find his words where he said that he was disappointed that they did not get anybody under the program they had. We tried to say they might not get too many unless they gave out a little public money which these companies were then interested in rejecting, but Dr. Libby did not get anybody under the program. He said:

> I was personally very disappointed to see that none of the proposals we received on April 1 included what I call the chemical type of reactor, that is, homogeneous type of reactor, which I believe is likely to give us the cheapest power at least in large quantities at stationary powerplants. I suppose if on the next go-round we still get nothing, I would be very strongly in favor of the Government going ahead on its own type of this development and I think that $25 million would apply in this case.

Did you get anything on the next go-round?

Mr. DAVIS. I believe he was still referring to the third round. I am confused on the date.

Senator ANDERSON. Was the third round going in 1955?

Mr. DAVIS. I am sorry.

Senator ANDERSON. That was the first round.

Mr. DAVIS. I am sorry, sir.

Senator ANDERSON. This was the first round, was it not?

Mr. DAVIS. In the third round we did identify the homogeneous reactor as one of the types that we would like to have. About this time we did have these difficulties with the homogeneous reactor No. 2 and upon considering this and some of the studies which were made, we decided that it simply was not reasonable for anyone, ourselves included, to try to construct a large-size homogeneous reactor by June of 1962, and therefore extended the date.

The Pennsylvania Power & Light has now come in as you suggest in this later invitation and made this proposal under the third round for such a reactor in accordance with the desires that Dr. Libby expressed.

Senator ANDERSON. You see Mr. Oaks, president of Pennsylvania Power & Light, was very positive when we had the hearings on the so-called Gore-Holifield bill. The testimony was given on Friday,

May 25, 1956. I read on page 226 where he tells how private industry is real anxious to go ahead. He said:

> Because of this it simply does not make sense to me at any rate that the Congress should undertake through some means such as S. 2725 the construction of power reactors over and above the power reactors now covered by the programs of the AEC and the electric utility industry.

It did not make any sense for that to be proposed. Yet he was not quite ready to go ahead after all, was he, and suggested a 2-year delay in this. We were trying to say let us get on with this homogeneous type that Dr. Libby says is extremely promising. I will use his exact words,

> which I believe is likely to give us the cheapest power, at least in large quantities at stationary powerplants.

Mr. DAVIS. I think our ideas as well as those of Pennsylvania Power & Light and Oak Ridge have changed about the time schedule here. This has not been a unilateral decision.

Senator ANDERSON. Also they changed their mind about the desirability of getting into the Federal Treasury. They wanted self-reliance. They didn't want any public money. They didn't want any assistance. They would not ask for it, even.

Mr. DAVIS. I think it is quite fair to say that they hoped to be able to proceed without it.

Senator ANDERSON. Yes. They hoped to be able to proceed without it. When did they start their research work on this project, Pennsylvania Power & Light?

Mr. DAVIS. I believe it was July of 1955.

Senator ANDERSON. Yes, it followed Dr. Libby's statement, did it not? All I am trying to find out, Mr. Davis, is this: You came before the committee, I would say very properly, and said to us as I pointed out on page 49, that Pennsylvania had this project. You may recall there were ads in the newspapers showing how private industry was just champing at the bit to start building these reactors. They could not hardly wait until the summer was over. You came before us and said on the basis of their representations to you—I want that clearly understood—that no assistance from AEC has been requested, although AEC's extensive program in aqueous homogeneous reactors is contributing knowledge of substantial benefit to this project.

Now, in compliance with keeping the committee fully informed, when did you first find that Pennsylvania Power & Light had changed its position and wanted assistance to the tune of some $30 million?

Mr. DAVIS. I can't recall the exact date, Senator, but it was some time, I would say, late last fall when we had discussions with them, we had followed the progress of their project, and discussed the possibility of their making a third-round proposal to us.

Senator ANDERSON. Wasn't their project included in one of the earlier rounds and listed as such in the tabulation that you presented to the committee?

Mr. DAVIS. As a part of the power demonstration program?

Senator ANDERSON. I am not sure.

Mr. DAVIS. I don't believe so.

Senator ANDERSON. When did you so notify the committee when you found there was a change in this proposal that no assistance would be required?

Mr. DAVIS. I don't believe the committee was notified until a proposal had been received by the Commission.

Representative PRICE. Would the Senator yield?

Senator ANDERSON. Yes.

Representative PRICE. Is this one that had been listed to have been proposed strictly by private industry?

Senator ANDERSON. Yes. I am trying to find out what private enterprise is; $30 million is in the private enterprise category, I am sure.

Representative PRICE. The point is that this was listed as one of those in the category.

Senator ANDERSON. Yes. Mr. Oaks was quite specific. He did not want any of this favor business in his. I am in favor of keeping with that. I think they ought to live by their lights unless they want to come in and say they made a mistake. I am not going to continue with that. As far as you knew, this was an extremely accurate statement, a completely accurate statement you made, that they had not then requested any assistance?

Mr. DAVIS. That is correct. Furthermore, they were engaged in spending their own money at that time and still are on their own quite large scale research and development program which certainly gives considerable weight to their statements.

Senator ANDERSON. Shortly after these hearings in 1956, did the AEC request funds for the government construction of a homogeneous reactor with a proviso that the government would construct only if no private proposals were received?

Mr. DAVIS. Did we request funds?

Senator ANDERSON. Yes.

Mr. DAVIS. To the Bureau of the Budget; yes, sir.

Senator ANDERSON. I believe you submitted, in October 1956, to the Bureau of the Budget a request for funds to build an aqueous homogeneous reactor with the proviso that you would do the construction only if private industry did not propose to do so.

Mr. DAVIS. Yes, sir. Such a request was part of the submission to the Bureau of the Budget.

Senator ANDERSON. I have no further questions on Mr. Davis' testimony.

Representative HOLIFIELD. Mr. Van Zandt.

Representative VAN ZANDT. Dr. Davis, last fall, wasn't it true that many of these corporations that are involved in the construction of atomic reactors for power purposes stated publicly that the cost had risen to the point where they had to review their entire program? In other words, I am trying to develop here that the cost factor disturbed all of them.

Mr. DAVIS. Mr. Van Zandt, last fall there began to be a great deal of discussion about cost factors in the nuclear power business. Some questions were raised about these in public speeches by various representatives of the manufacturers and the utilities. I don't know that any of them got quite as extreme as you imply. There has been and continues to be quite a bit of discussion.

Representative VAN ZANDT. They did show concern?

Mr. DAVIS. They certainly showed concern; there is no question about that.

Representative VAN ZANDT. Is it not true that the Pennsylvania Power & Light Co. underestimated the cost of this project originally?

Mr. DAVIS. They certainly have revised their estimates somewhat. I can't recall offhand to just what extent. Actually when they first started I don't believe that one could say that they had really very firm estimates of the cost of construction. They were spending their money on research and development. I well recall when I visited with them out there that they did not during the early stages have any firm idea as to what the cost was going to be, nor did they have any firm idea as to where they were going to get the money to finance the various stages of the project. These things have both evolved. I don't believe, if my memory serves me correctly, that they have very greatly underestimated at any time the cost of construction. It is not one of these things that is an order of magnitude by any stretch of the imagination.

Representative VAN ZANDT. Based on your general knowledge of the industry, have the costs increased to the extent that it warrants the concern that we mentioned a moment ago?

Mr. DAVIS. Mr. Van Zandt, it is a very complicated thing. Actually costs in general, as you know, have been escalating at 5 or 6 percent a year for a number of years. This is one very definite factor. Other people have found that the costs of building nuclear powerplants were higher than they thought they were going to be even though they made to their best ability quite realistic estimates. There have been other cases where there have been initial estimates which simply were not good at all and where the actual cost when a good estimate was made turned out to be very much higher. Whether these things are really the costs of nuclear power is something else again. I think actually the real costs of nuclear power and nuclear powerplants are coming down. At the same time some of the estimates are going up. The situation is certainly extremely confused.

Representative VAN ZANDT. Doctor, back in 1955, was it possible at that time to accurately estimate the cost of constructing this type of reactor?

Mr. DAVIS. No, sir.

Representative VAN ZANDT. It was not?

Mr. DAVIS. No, sir.

Representative VAN ZANDT. How much money has the Pennsylvania Power & Light Co. spent to date of their own funds on this project?

Mr. DAVIS. About $5½ million.

Representative VAN ZANDT. How much has the Government spent to date?

Mr. DAVIS. On the entire aqueous homogeneous development project, I could guess, or I could try to get a number for the record. It is certainly of the order of 25 or 30 million dollars, and perhaps more.

Representative VAN ZANDT. Under the provisions of the contract, the Government will spend in round figures about $30 million, is that right?

Mr. DAVIS. That is correct.

Representative VAN ZANDT. Is it not true that the Pennsylvania Power & Light plan to spend about $79 million on this project?

Mr. DAVIS. Yes, sir.

Representative VAN ZANDT. Is this schedule of spending on the part of the Government and the part of the Pennsylvania Power & Light Co. unusual in this field of atomic reactors?

Mr. DAVIS. No, I don't believe so. I would like also to take the opportunity to point out that the homogeneous reactors are not going to be utilized by utilities until the manufacturers get into the research and development and into the business of supplying the components. Oak Ridge is not going to build commercial homogeneous reactors. At some point there has got to be a sizable investment in companies such as Westinghouse doing research and development before they can become commercial.

Representative VAN ZANDT. This $79 million that I mentioned a moment ago, is it being spent jointly by the Pennsylvania Power & Light Co. and Westinghouse?

Mr. DAVIS. Yes, sir.

Representative VAN ZANDT. If phase I of this project were to be concluded, taking into consideration the money spent by private interests as well as the Government do you think that money spent up until that time will have produced any technology that will benefit the reactor field in general?

Mr. DAVIS. Very definitely.

Representative VAN ZANDT. If the Government and private industry enter phase II, do you think that the effort there will further the interest of the atomic power development?

Mr. DAVIS. I believe it will. Certainly if it results in an operating full scale homogeneous reactor, it will be a very great step forward.

Representative VAN ZANDT. In other words, you believe this type of reactor is possible, and it would be a contribution to the ultimate objective, a homogeneous type of reactor.

Mr. DAVIS. Yes, sir.

Representative VAN ZANDT. That is all, Mr. Chairman.

Representative PRICE. May I ask a question, Mr. Chairman?

Representative HOLIFIELD. Mr. Price.

Representative PRICE. Mr. Davis, is it not true that as far back as 1956, that people who were engaged in building and planning power demonstration reactors recognized the unreliability of cost estimates?

Mr. DAVIS. There has certainly been some unreliability, Mr. Price.

Representative PRICE. Anyone who was going to proceed in this power demonstration program knew that he was taking a considerable financial risk relying upon estimates at the start of such project?

Mr. DAVIS. There is always a degree of uncertainty connected with any estimate. I don't think the implication that all cost estimates for nuclear powerplants have been bad is quite true. I think some of the people have managed to make pretty good ones. Some of them have made very poor ones. I just don't want to generalize on that statement because some of them have not been had.

Representative PRICE. Perhaps you cannot generalize, but certainly a company as large as Pennsylvania Power & Light knew that they were taking a risk of a financial nature in relying upon estimates then available to them, did they not?

Mr. DAVIS. Certainly.

Representative PRICE. Is it not true that the Pennsylvania Power & Light Co. through its president testified that they were prepared to

do the job and they pleaded with this committee to prevent the Government of the United States, under the circumstances that they were prepared to do the job, from intervening? Isn't that true?

Mr. DAVIS. I read Mr. Oaks' testimony. I recall that he did say they were prepared to go ahead and he was opposed to the Government actually constructing a full-scale reactor.

Representative PRICE. I will read Mr. Oaks' testimony to you. This is in the hearings on page 227 of May 25, 1956. Certainly by that time he should have known something about the financial risk involved. Mr. Oaks stated there:

What I am saying here, Senator—

I think he was in a discussion with Senator Anderson—

is that the public utility industry is prepared to do this job and under those circumstances the Government of the United States should not intervene.

Is it not true if we go into this phase II program the Government will be intervening in Mr. Oaks' program?

Mr. DAVIS. I certainly see your point, Mr. Price, but I don't think I would agree it is quite that way.

Representative PRICE. We certainly will be. We will be intervening financially, and that would be a healthy intervention.

Mr. DAVIS. I think we would be assisting a very worthwhile project to proceed, which I am afraid will not proceed unless we do assist.

Representative PRICE. Isn't it right that Mr. Oaks could only testify as to the change in mind or change in position? It might be a good thing if Mr. Oaks would be called before the committee and let us know some of the difficulties he has encountered in this project that has caused him to change his mind.

Senator ANDERSON. I think it is apparent that what he was at that time engaged in was an effort to be sure that we did not pass a public power bill, as he regarded the Gore-Holifield bill. He testified very fluently on that subject at that time. Now if there is a little less danger, then it is all right to come in and ask for this money.

Representative PRICE. He certainly had some reason for changing his mind. It might be a perfectly legitimate one. Circumstances might have changed in the last year and a half. I just don't see that there has been that great a change in the position of this program in a year and a half such as to cause such an about-face on the part of the company representative?

Representative HOLIFIELD. If the gentleman will yield, the program has not changed. It is just a change of mind in the evaluation of some of the people who were looking at this through rose colored glasses. They are now seeing it in the stark daylight, and it looks a little different to them. The romance has faded.

Representative PRICE. That is probably true.

Senator ANDERSON. Mr. Chairman, in 1955 or 1956, there was a feeling that it would take 2 years of study before they could go ahead. Is that still the situation in 1957? I have the hearings starting in April and running through June in 1957. On page 57 of the hearings on the authorizing legislation, General Fields was testifying and he gave the justification for the budget request for aqueous homogeneous reactor development. At the top of page 58 he says that invitations would be extended to industry to participate in the

construction of such plants either entirely or largely at their own expense with a minimum of Government assistance in research and development. In the event of a negative response from industry, it was planned to proceed with these projects using AEC funds as necessary. No site locations have been determined.

In 1958, we are going to wait 2 more years while Pennsylvania Power & Light makes up its mind. Presumably in 1958 we might then go ahead.

General Fields, at page 220 of the hearings of the 85th Congress, 1st session, has this language:

> On June 7, 1957, a letter to Congressman Durham, I indicated that in the case of the aqueous homogeneous reactor demonstration plant we were deferring the specified completion date to at least June 30, 1963. The point of Commission decision with respect to proceeding with a Government-financed project is, therefore, also deferred about 1 year to January 1959.

This morning it is deferred to January 1960. Each year we move a year ahead.

Representative PRICE. The decision was deferred.

Senator ANDERSON. That is what is offered this morning; the testimony is that we will wait 2 years.

Mr. FIELDS. Senator, I think what has developed is that there is a substantial research and development that remains to be done—that is more than we visualized a year or 2 years ago before you know whether you come forward with a feasible plant for construction. That is certainly in our minds now where it was not perhaps a year or 2 years ago.

Senator ANDERSON. It was in the minds of the committee 2 years ago. We tried our very best to point out that private enterprise was not ready to go ahead. But Mr. Oaks was pretty sure. He had the timetable. I am not criticizing him for his timetable, but he had a timetable that I assume he is going to come down and testify about, and tell us how it changed month by month and year by year.

The point is that in your letter, Mr. Fields, dated June 28, 1957, you announced to the committee that the date for decision as to whether you are going ahead with it or private industry was going ahead was January 1959. Now you are ready to testify that some time in 1960 this will be true.

Mr. FIELDS. As I recall the letter——

Senator ANDERSON. I don't want to take advantage of you. I will let you look at it.

Mr. FIELDS. All right, sir. As I recall, Senator, that had to do with the time at which we would determine whether there was a project going forward, and if not that Government funds would be requested to build it by that time.

Senator ANDERSON. Precisely. This is January 1959. If you are going to give these people, and you certainly have recommended it, $7,300,000 for 2 more years of research after this current date, which is late in March 1958. You certainly are going to let them do the 2 years' work, aren't you?

Mr. FIELDS. This does propose the initiation of a project which involves research and development for that time, yes, sir.

Senator ANDERSON. So that brings it up to April or so of 1960.

Mr. FIELDS. For the actual construction it would.

Senator ANDERSON. For the decision, too. While they are pouring this money in, you mean you are going to decide to take it away from them and do it yourself? Of course not. You will let them work for 2 years.

Mr. FIELDS. No, sir, you would need research and development, I believe, even if it were just a Government project that was initiated at that time.

Senator ANDERSON. I do not question that. I read the statement that these people were going to have 2 more years.

Mr. FIELDS. There is a difference between the initiation of the project and the initiation of the construction. This is certainly true, Senator Anderson. The research and development would be a necessary parallel to any construction project that was started.

Senator ANDERSON. Dr. Zinn has been proposing for a long time the construction of a little different type—not the slurry type, but another type—at page 84 of the hearings of 1956, which was on authorizing legislation, a different hearing from the one I referred to previously, he says:

> Although there has been a great deal of development of the homogeneous aqueous reactor and although the goals set for this reactor under its present development is really the very highest type of performance we have to admit what is lacking in this very attractive type of reactor from all points of view, economy, safety, and so on, is large-scale experience. The homogeneous reactor suffers in comparison with other types on this count. We know that the Shippingport reactor very likely will operate almost 100 percent of the time and very successfully, because there is other large-scale similar experience, namely, the *Nautilus*, the land-based version of the *Nautilus*, and even our other water-cooled reactors. But the homogeneous reactor lacks large-scale application. It might be wise to undertake a large-scale homogeneous reactor, lowering the performance goal from what is the best we can envison in order to get a very early plant. By lowering the performance goal one avoids some of the now technically unsolved problems having to do with corrosion and so on.

There was a report by the technical appraisal task force on nuclear power to the board of directors of the Edison Electric Institute, and in that report they list the reactors in a sort of priority. This is not binding on the Commission, but it is somewhat impressive to the people who followed the studies. They list what ought to be done as they see it. They list the boiling water with nuclear superheat. That is the first one they would do. That could be completed in 1958–62. Then a gas cooled graphite moderated which is under study by a contractor to the AEC. Then they list aqueous homogeneous solution which is also under study by contract with the AEC. These people think they could get under way pretty quickly. But we are going to put it off 2 more years.

Mr. FIELDS. The letter you referred to indicated that the construction would be moved to completion sometime in 1963. We were talking about the initiation of a project. If a project had not been initiated by January 1, 1959, as I recall we would request authorization for a Government project. This is the initiation of a project. In the letter we indicated that the construction would be completed by 1963. We recognized that this made it in time later. I don't believe the letter spoke of the initiation of the construction as such, but of a project. To me the project would contemplate necessary development, because this involves a great deal of engineering development of

engineering feasibility of components for this type of reactor that must go forward.

Senator ANDERSON. I am just using the book title, Year of Decision. That is what we are dealing with. Your letter on Year of Decision says the point of Commission decision—it didn't say construction—with respect to proceeding with a Government financed project is therefore also deferred about 1 year to January 1959.

Mr. FIELDS. That is correct.

Senator ANDERSON. If it was deferred 1 year to January 1, 1959, was the previous year of decision January 1958?

Mr. FIELDS. It was approximately that, I believe, yes, sir, when we went forward with the first request.

Senator ANDERSON. That applies on natural uranium.

Mr. FIELDS. Yes, sir.

Senator ANDERSON. But the year of decision was to be January 1958. Because the Gore-Holifield bill was just right there in the Congress and there was going to be a decision January 1, 1958. Now when we get to 1958, the year of decision moves to January 1, 1959. We will admit that, won't we?

Mr. FIELDS. That was because of developments in the homogeneous work as I recall. It had not moved forward as rapidly.

Senator ANDERSON. All right. We move it a year. Now this morning in Mr. Davis' testimony he said:

As the company stated in their proposal, while research work to date indicates that there are no insurmountable technical difficulties, approximately 2 more years of research and development will be necessary before a prudent decision can be made as to the construction of the proposed plant.

Would you not say that would postpone the Commission's decision until after the private company had reached its decision?

Mr. FIELDS. Not for the initiation of a project, sir. That would be for the construction depending on it being proven feasible during this development period.

Senator ANDERSON. General Fields, would you say to me here that having encouraged this company to go ahead, having accepted their proposal which says they are going to need 2 more years to reach a decision, having announced that the Government won't do it unless the companies are unwilling to do it, that you would then ignore their proposal and make your decision without regard to their decision. Surely you don't mean that.

Mr. FIELDS. Senator, this is proposing our decision now. If this goes forward on this basis as proposed, we would not request authorization for the Government to build a reactor of this type.

Mr. RAMEY. Would it be possible that you might consider this other type, the solution type, as recommended in the Edison Institute report, of going to a prototype size of it because you don't necessarily need as much development work and so on, and you can use your Oak Ridge experience better along the lines that Dr. Zinn indicated of a very dilute solution.

Mr. FIELDS. May I ask Dr. Davis to speak to that question?

Mr. DAVIS. We have looked into the solution type of reactor, but this does no breeding whatsoever. It does no conversion. It makes no plutonium. It does not seem to be an attractive kind of a reactor at all. It is true that one could build a relatively large dilute solution-type reactor but this bears very little relationship to the problems that

are inherent in either the two-region breeder reactor or the type that is proposed by Pennsylvania Power & Light-Westinghouse.

Mr. RAMEY. You would learn a lot about the operating of a homogenous reactor.

Mr. DAVIS. You would certainly learn something about it, but it would be a somewhat different problem.

Representative HOLIFIELD. Your extrapolation as to size and corrosion would be very similar, would they not?

Mr. DAVIS. They would be similar in some respects but I think one of the points to bear in mind here is that the breeder reactor—the blanket of the breeder reactor—and the single region of the reactor proposed by Pennsylvania Power & Light are not solutions. These are not highly corrosive solution. These are suspensions of solids in heavy water. The problems of corrosion which you have are entirely different. There is a problem also of erosion with the suspension-type things. These are really quite different kinds of reactor technically and you are not going to find out the problems of one by experimenting with the other.

Senator ANDERSON. You said this aqueous homogeneous solution was not a very attractive type, did you not?

Mr. DAVIS. The pure burner is not.

Senator ANDERSON. What type was the Wolverine reactor?

Mr. DAVIS. This would have been a small pure burner-upper, so-called.

Senator ANDERSON. Like this one that he is talking about here, only larger.

Mr. DAVIS. The Wolverine one would have been very considerably smaller than what is implied there.

Senator ANDERSON. Didn't the Atomic Energy Commission approve that one, and if it is not a very attractive type, however, did it happen to do so.

Mr. DAVIS. We approved it at one time when the cost of building it was supposed to be rather low and the cost went up by a very large factor.

Senator ANDERSON. If it was the type that was not attractive, why did you approve at any price? If it was not a good type, why did you offer to put any money in it? You were going to put in several million dollars.

Mr. DAVIS. Senator, it is perhaps economic to simply burn up U–235 if the cost of doing it is not large. But if the cost becomes high, then you have simply got no possibility of this becoming an economic reactor.

Senator ANDERSON. Do I understand, then, that it was the cost of construction of the Wolverine reactor that changed the economics of the reactor?

Mr. DAVIS. Yes, sir.

Senator ANDERSON. That changes it by a rather large factor. I forget the number.

Mr. DAVIS. It jumps from $5,400,000 to $15 million, or something of that nature.

Senator ANDERSON. Right after we finished consideration of the bill on the Senate floor. That stayed at $5,400,000 until we disposed of the bill on the floor, and within 30 days that went up to $14 billion.

If the type is desirable, what is wrong with the report of the Edison Electric Institute? It is the same type.

Mr. DAVIS. I am sorry, sir, I don't recall that particular paragraph in there.

Senator ANDERSON. I am sorry. I just read what they said, aqueous homogeneous solution under study by contract to the AEC. I assumed you knew what it was.

Mr. DAVIS. I am not certain they were talking about the dilute solution or about the larger and more concentrated solution reactor.

Senator ANDERSON. It says here the reactor projects listed in table 2 are given in a rough order of priority with a time interval during which it is estimated the project will be undertaken and completed. Second generation reactors are scheduled in such a way that operating experience of the first generation reactor can be applied to the design of the second. In each project research and development and preliminary data are expected to precede a decision to construct, and so forth.

As I said, this came from the Edison Electric Institute which is not a sort of public power advocate.

Mr. DAVIS. I am sorry, sir.

Senator ANDERSON. I am trying to say this is not a prejudiced witness. The Edison Electric Institute is not what you would call a red hot advocate of the Gore-Holifield bill.

Mr. DAVIS. I would not classify them that way.

Representative VAN ZANDT. Doctor, getting back to Mr. Oakes again, did he at any time tell you why he changed his mind?

Mr. DAVIS. I have not discussed this with Mr. Oakes. I have dealt principally with Mr. Busby who is here this morning. I think you probably would want to explore this with him. My recollection of this certainly is that they have been able to firm up their costs and they have sought support from other utilities and other organizations and simply were not able to get a sufficient amount, and we therefore were able on a research and development basis to find a way of going ahead with this in this manner.

Representative VAN ZANDT. Mr. Chairman, can we ask Mr. Busby whom I see sitting over here to go into some detail and tell us why Mr. Oaks changed his mind?

Representative HOLIFIELD. Mr. Busby, if you are going to be a witness, will you come forward and occupy one of the chairs, please. We would be very happy to have you come forward. There seems to be some interest in the present position of the Pennsylvania Power & Light Co.

Mr. BUSBY. I would suggest that Mr. Weaver and Dr. Johnson join me up there.

Representative HOLIFIELD. We will be glad to furnish chairs to all you gentlemen.

Representative VAN ZANDT. Mr. Busby, tell us why the Pennsylvania Power & Light Co. became interested in this type of reactor, and when.

Mr. BUSBY. I think the questions this morning have brought out that as a part of the Atomic Energy Commission's early designation of 5 reactor types that held potential promise for economic nuclear power, 1 of those types was the homogeneous type of reactor. I think reference has been made to Commissioner Libby's position about the

desirability of developing a so-called chemical type of reactor because of the very severe problems in fuel fabrication and reprocessing with the solid fuel element types. I think the questions this morning also brought out that the emphasis on the potential promise of the homogeneous type had reached a point of, shall I say, major emphasis by and in 1955, bearing in mind, of course, that the Atomic Energy Act of 1954 was only enacted in August of that year.

It was in July of 1955 that Pennsylvania Power & Light Co. and Westinghouse entered into an agreement with respect to investigating the feasibility of the homogeneous type. That contract was a 2-step contract, just as, indeed, our proposal is a 2-step proposal. That contract provided that the 2 companies would together put up $5½ million over the period which we thought would run to about the end of 1957 to do such research and development work in extension and as a byproduct, as Mr. Davis pointed out this morning, of the work at Oak Ridge, to see if it would be technically and economically feasible to build a large-scale homogeneous powerplant on the Pennsylvania Power & Light system.

I would say that our concept at that time was that the two companies would be willing to put up a substantial amount of money over and above any of the costs that you would incur in a conventional plant if through spending that money they could see their way to having a powerplant which, if you didn't have that research and development cost burden to account for, would produce economically competitive power. That is the basis on which we started.

The first step was to spend $5½ million to look inside the package, and if we, with that look, found that we could realize that objective the thought was that we would spend substantially more research and development money.

One of the things that we had in mind when we originally went into this was that underwater maintenance could be the answer to maintenance problems with this reactor type. In spending $5½ million we learned a lot more than we did when we started.

One of the things we learned was that there were a fistful of problems here. Certainly we had not reckoned fully with them. I would say that we approached the nature of difficulty of this particular reactor type with a considerably more humble spirit, you might say, than we did some 2½ or 3 years ago. Be that as it may, we found through spending this money that a very substantial additional amount over and above what we had expected would be required for research and development costs.

We further came to appreciate that even apart from spending that money, the very best that we could hope for in the way of power costs would be power costs substantially more than the power costs produced by a conventional coal-burning plant. This led us to make a reappraisal of the economic feasibility of this plant as well as the technical feasibility problem. We reached the conclusion that if research and development assistance could be obtained from the Atomic Energy Commission and the full amount that we had already said we were willing to put into this project in the way of research and development could be applied to the higher operating and capital costs of the plant, that the combination of these excess funds, so to speak, over and above normal costs, there would be a reasonable pros-

pect of justifying going ahead with the project and building the plant.

I wish I could say to this committee this morning that we tell you surely that 2 more years of research and development and $7 million will put us in a position to know exactly where we stand, and that it will be technically and economically reasonable to go ahead with building a large-scale plant. I cannot tell you that, because this is 1 of the things we are going to spend the next 2 years to find out. We have simply a program here which from our standpoint, let me say, we are approaching in good faith to do what we can do to develop the art here, and build a powerplant in the nuclear field consistent with considerations of prudency.

In defining our standard of prudence we have gone beyond the concept of economic power. We are willing to spend substantially more money over and above the cost of the conventional plant.

Representative VAN ZANDT. Mr. Chairman, may I ask Mr. Weaver a question? Is it not true, Mr. Weaver, that all during this period of research in this field that there has been an exchange of information between Westinghouse and Oak Ridge?

Mr. WEAVER. A very complete exchange, Mr. Van Zandt, and full cooperation in order to utilize the best efforts of both parties.

Representative VAN ZANDT. This exchange has taken place even though Oak Ridge is going in a little different direction than you are?

Mr. WEAVER. Yes; and it has existed from the very beginning of our work in 1955.

Representative VAN ZANDT. Now, let me ask General Fields a question. If the Government were to finance the entire cost of this research, what would it cost in round figures?

Mr. FIELDS. Do you include in that the construction expenditures, also, Mr. Van Zandt?

Representative VAN ZANDT. Until we had a prototype operating.

Mr. FIELDS. It would amount substantially to the total here of our expenditures and the Pennsylvania Power & Light expenditures.

Representative VAN ZANDT. In other words, about $110 million.

Mr. FIELDS. Of that order; yes, sir.

Representative VAN ZANDT. Under the provisions of this contract, we are going to get a prototype, we hope?

Mr. FIELDS. We would hope; yes, sir.

Representative VAN ZANDT. By 1963. The taxpayer is paying $30 million, and Pennsylvania Power & Light and Westinghouse are spending approximately $79 million.

Mr. FIELDS. That is correct, sir.

Representative ASPINALL. If my colleague will yield at that point, if we just proceed to phase II, how much would it cost the Federal Government?

Mr. FIELDS. Approximately $7 million, sir.

Representative ASPINALL. In other words, it would not cost us any more to proceed with the expenditure of Federal funds at Oak Ridge than it will cost us to proceed with the partnership program with the two companies; is that correct? What I am trying to find out—and I am new in this activity—is whether or not the taxpayers will receive anything from the expenditure of the $5½ million heretofore made by 2 companies that will be a foundation for the further expenditure of the $7 million plus as proposed in phase I.

Mr. FIELDS. Unless we are proceeding with this particular type of reactor, I don't believe that we would incur the phase I expenditures of this nature at Oak Ridge.

Representative ASPINALL. Let me ask the question in this way. What has been accomplished upon to the present time by these 2 companies by the expenditure of $5½ million in this particular kind of reactor?

Mr. FIELDS. Perhaps they could speak to exactly what has been accomplished in that research and development better than I could at this time.

Mr. WEAVER. I would like to ask Dr. Johnson, who has headed the project for Pennsylvania Power & Light and Westinghouse since its inception, in 1955, if he would answer that question.

Representative HOLIFIELD. Dr. Johnson.

Dr. JOHNSON. We submitted to you about a month ago I believe in the 202 hearings a résumé of our progress to date. Perhaps I could best summarize that statement again today.

Of the $5.5 million, about $2 million is in facilities of very special test nature. These are large engineering test facilities for the handling of slurry fuel. We now have facilities of this type which are second to none in the country and which are considerably larger than those in use at Oak Ridge National Laboratory.

We have developed in considerable detail preliminary layouts of such a plant, aimed particularly at the problem of how will you maintain such a plant. As a result of this work, it has been necessary to essentially throw out the concept of underwater maintenance which was developed at Oak Ridge for a smaller reactor but which is not applicable when you extrapolate to a large size reactor.

In the large size reactors which Oak Ridge is now studying, they also have now come around to our concept of dry maintenance compared to underwater maintenance. We have developed in considerable detail much of the equipment and techniques that are needed for remote maintenance. We now have developed, as an example of this, a welding machine for completely remote welding of stainless steel pipe. We have done considerable work on the handling properties of the slurry. We have done considerable work on the development of equipment—large-scale equipment—which is susceptible to remote maintenance, a large-scale steam generator, a large-scale pump.

We have built one large engineering test facility which is half the size of a loop which would actually be in the final plant. We have established a group of competent technical people now numbering between 100 and 120 who have been through indoctrination period of what are the problems in this type of reactor and what does it take to solve them, and have a real going organization.

We have not in looking at all of these problems as has been stated here come up against any problem which we think is insuperable. There are 2 or 3 areas that require considerable work. One is the effect of radiation on the corrosion properties of the slurry. This is a program where Oak Ridge and ourselves have jointly developed a rather extensive program in which we are doing engineering development of the equipment which is the equipment that will be placed in the reactor.

Oak Ridge National Laboratory will operate this equipment in the new Oak Ridge research reactor, and will do the hot radioactive examination of the specimens that are included.

A second area is that of lost distribution in very large pressure vessels. We have a rather extensive program and rather extensive facilities now for doing this work. But we have not concluded this portion of the work in time to meet our original schedule. This is a very critical area, because one of the first items that must be ordered on a plant is the pressure vessel itself. There is some 40 months delivery time on such an item.

The third area is still the handling properties of the slurries and the fourth area, remote maintenance. These two areas just need more detailed development rather than real technical feasibility of proceeding.

I would say that if a new organization, even Oak Ridge National Laboratory, was to take up our program as of now, it would require them a minimum of a year to get to the point, including facilities, to where we are now, and the expenditure of a very large fraction of the $2 million that we have spent in facilities.

Senator ANDERSON. Do you agree with that, Mr. Davis?

Mr. DAVIS. Yes.

Representative VAN ZANDT. Doctor, how long have you been identified with this atomic power business?

Dr. JOHNSON. Most of my professional life, I would say. I got my degree from Brown University in 1932. In 1942 and 1943 I was on the staff at Syracuse University and left in January 1944 to go to Oak Ridge with the Tennessee Eastman Co. I then transferred to Oak Ridge National Laboratory in 1947. I came to Westinghouse, Bettis Field, in early 1949, and have been associated with the work at Bettis Field up to 1953, and have been in our commercial activity since that time.

Representative VAN ZANDT. I imagine as you functioned as the physicist in charge of this project you called upon others in the Westinghouse organization to make their contribution?

Dr. JOHNSON. Very definitely. A large fraction of our activity is in other divisions of the company. In the development of the slurry circulating pump, as an example, this work is done by our Atomic Equipment Department at Cheswick, which has done all the work on the pressurized water pumps.

The Steam Division has been doing extensive work on the steam generator. In many respects you must remember that the components for an aqueous homogeneous reactor are quite similar to those used in a pressurized water reactor. The aqueous homogeneous reactor is a pressurized water reactor from my view of the design standpoints.

Representative VAN ZANDT. Therefore, when you say this project as it has been developed to date has made a contribution to the state of the art, you have behind it all of the experience of yourself and the Westinghouse organization.

Dr. JOHNSON. Very definitely.

Representative HOSMER. If the gentleman will yield, Dr. Johnson, there is a point that you made that might deserve bringing up further. Do I understand you correctly to say that if your organization

stopped this work, it would take a year to put together another organization to pick up where you left off?

Dr. JOHNSON. This was my estimate. It includes, of course, not only the technical personnel, but the facilities. The large-scale engineering test loop which we now have in operation could not be duplicated in a year because of the delivery time on the pieces that are involved.

Representative HOSMER. But this situation is not peculiar to your particular project. What I am getting at is, where you have a scientific team assembled, it has taken not only time to get the bodies in one location, but a great deal of time to get them functioning in coordination with each other.

Dr. JOHNSON. This certainly is a major accomplishment, I believe, that we have made, that is, getting a competent technical group together which now recognizes what the problems are.

Representative HOSMER. And a great part of this $5½ million was probably expended just assembling this unit to do the work; is that right?

Dr. JOHNSON. Very definitely.

Representative HOSMER. If you chop that off at this point, you lose whatever those results could be calculated to be, as well as the time in pursuing your line of research, is that right?

Dr. JOHNSON. Very definitely. As we pointed out, I believe in the last 202 hearings, we have in this 2½ years made two rather complete plant studies. The first of these took 8 months, the second took 9 months. It is only by going through such a study in considerable detail that you really recognize all of the problems that face a development of this type of a plant.

Representative HOSMER. Then if this line of work were to be transferred to a Government laboratory or any place else as of tomorrow, unless you pick up all the bodies and move them, and all the equipment, you would incur a loss in time of a year, plus an additional expense of reassembling all these human beings and equipment.

Dr. JOHNSON. I think the estimate of a year is being very optimistic. I don't think you will do it shorter than that.

Representative HOSMER. This is the situation that pertains not just to this project but in general to a substantial research and development project in an unknown field.

Dr. JOHNSON. That is true.

Representative HOSMER. Do I understand the testimony of yourself and others to be that the pursuit of this line of inquiry not only has contributed substantially to reactor power technology in the United States, but promises to make further substantial contributions?

Dr. JOHNSON. I would say certainly in my opinion there is no question but what we have made and will continue to make substantial contributions to the overall art.

Representative HOSMER. I take it by that you mean not only to the art of this particular type of reactor, but to the general art and the general technology of power reactors, in the achievement of economic nuclear electric power in the United States. Is that right?

Dr. JOHNSON. I think I can give you a very good example of this. This morning in coming down on the plane Mr. Weaver and I were discussing this particular problem, and I said it would not surprise me if the Yankee plant was put together using our welding machine.

Representative HOSMER. Your mentioning of the airplane was a reason for my line of questioning because I am from California, and every time I go out there the plane is halfway or three quarters loaded with scientific people going out there looking for jobs and coming back it is the California scientists coming back here to look over jobs. If we could get our scientific people out of airplanes and on the job, we would get along very much better.

Representative VAN ZANDT. Mr. Chairman, I want to ask Dr. Johnson another question. I was impressed when I visited your laboratory in Pittsburgh with the loop development. I also had a chance to see the loop development at Oak Ridge. Isn't it true that you people have really made great progress in this particular field?

Dr. JOHNSON. Yes, I think we have made very, very good progress. Again to show the relation between Oak Ridge and ourselves, the first loop that we built was essentially a duplicate of a loop that was built at Oak Ridge National Laboratory. The largest loop they had built to date. We very shortly built three other loops which were marked improvements on this. Based on this experience we then went ahead and developed the very large scale loop we showed here last week. I would say at the present time we do have better facilities for this type of work than Oak Ridge National Laboratory.

I must emphasize that these are engineering type facilities. The large scale engineering that Dr. Davis referred to rather than the basic research type which must also be done.

Representative VAN ZANDT. That is the point I want to develop. I have one more question, Mr. Chairman, and then I am finished. Did I understand you to say, Mr. Busby, that the Pennsylvania Power & Light Co. agreed to spend $5½ million and the Westinghouse Corp. agreed to spend $5½ million, is that right?

Mr. BUSBY. No, sir. We had a program underway which we would jointly spend $5½ million. We had as a part of that program the understanding that we would spend very much more than that for additional research and development in connection with this project. We have not mentioned that figure because there are considerations involved similar to GE does not want to disclose what the Dresden plant is costing them. If the committee wishes the figure we will provide it.

In any event, the point is that we are not changing our commitment of additional outlay for this project one dollar by reason of any research and development assistance that we are requesting under this proposal.

Representative VAN ZANDT. In the event that the contract goes into effect, and the Government is going to spend, we will say, $7 million on phase I, how much more will you and the Westinghouse Corp. spend during this 2-year period?

Mr. BUSBY. This is something that will be affected somewhat by the nature of the final details of the arrangements as to what is considered a proper AEC cost in terms of being entire attributable to this 2-year period. Sometimes the equipment has a life that is more than 2 years, and then in that respect we will be paying a portion of that cost. So we will be spending some money over and above AEC funds. But I would not say that we expect it to be a very substantial amount. We do not expect it to be a very substantial amount.

Representative HOLIFIELD. As a matter of fact, to keep the record straight, you have spent $5½ million, you are now asking that the AEC take over the burden of research and development from a financial standpoint. $7 million in the phase I and up to $22 million more in phase II in case you go ahead.

Mr. BUSBY. Mr. Chairman, that is right, but Mr. Van Zandt's point was that there are some costs associated with this project which AEC under their normal way of procedure would not recognize as being research and development reimbursible costs by them but the money has to be spent just the same. That would be in addition.

Representative HOLIFIELD. You are getting the advantage of all the technology in this field. The amount that we have now and the amount that would be obtained at Oak Ridge in the future will all go into the project if there is any value to you without any cost. That is not included in the $22 million.

Mr. BUSBY. There is no question about the fact that the technology here is open both ways. In other words, the $5½ million worth of knowledge we bought has been fully available to Oak Ridge. If this project goes for 2½ years, and we find it not prudent to go ahead, then we will have paid for the research cost during 1958 and 1959 and that will be $12.5 million we will have spent and all of that knowledge and information will have been fully available to this committee and Oak Ridge and to AEC.

Representative HOLIFIELD. And you will have in your own right all equity rights to the research and development which accrue during that $12.5 million expenditure.

Mr. BUSBY. What value that has.

Representative HOLIFIELD. At the present time you have the equity rights which you are entitled to under your $5½ million expenditure.

Mr. BUSBY. I wish I could sell them for $5½ million. I don't think we can.

Representative HOLIFIELD. I am sure you cannot. The question remains that you do have those rights.

Mr. BUSBY. Yes, sir.

Representative HOLIFIELD. At the conclusion of the expenditure of $30 million in the field of research and development under this particular contract, will you or will you not have the rights to the research and development under the balance of the expenditures by AEC?

Mr. BUSBY. The provisions in that respect in terms of patent rights and so on for this project will be the same as were established in the case of Northern States Power, which is that the party really paying the money gets the basic rights.

Representative HOLIFIELD. Are you telling me, then, that if in the expenditure of this additional $30 million that the Westinghouse or the Pennsylvania people will not acquire any additional patent rights?

Mr. BUSBY. We won't be the prime patent holders because under the arrangements which the Commission has established—and if I am in error in this I hope I will be corrected—where the AEC is putting up the money any patent rights derived from spending of that money are primarily of AEC.

Representative HOLIFIELD. For the purpose of AEC use only and not for the purpose of the general public.

Mr. DIAMOND. Mr. Holifield, I think that is for the general public.

Representative HOLIFIELD. That is what I am trying to find out. I want to get on the record that the $30 million which will be expended in this field for research and development, if we go through phase I and phase II, will be an equity value of the AEC and therefore transmissible to all the industry.

Mr. DIAMOND. That is correct, sir.

Representative HOLIFIELD. That does not give them any rights to the $5.5 million which has been spent in individual research.

Mr. DIAMOND. By the companies, that is correct.

Representative HOLIFIELD. By Westinghouse and Pennsylvania Light people. Is it not also true that you are asking for a retroactive clause in this proposal which will pay you some $300,000 a month for each month of this year from January 1 which you are now spending in your own laboratories and without any commitment at all from the AEC, and that this will amount to something over a million dollars of refund of moneys which are expended and which AEC has no commitment on at the present time?

Mr. BUSBY. Mr. Chairman, it is perfectly true that we are spending money going ahead with the project, taking the risk that the proposal that we filed would be accepted by AEC and would be approved by this committee.

Representative HOLIFIELD. In other words, the $7 million is retroactive to January 1.

Mr. BUSBY. Yes, sir.

Representative HOLIFIELD. And will reimburse you for such research and development you have expended since January 1.

Mr. BUSBY. Yes, sir.

Mr. FIELDS. 1958.

Representative HOLIFIELD. Yes.

Representative VAN ZANDT. Mr. Chairman, may I ask General Fields a question. Is it not true that this type of contract is one of three contracts?

Mr. FIELDS. There is one actual contract with Northern States. We have submitted to this committee the East Central Nuclear Group–Florida West Coast Group proposal. We have one contract and one proposal before the committee of the same sort.

Representative VAN ZANDT. It does not stand out alone.

Mr. FIELDS. No, sir.

Representative VAN ZANDT. That is all, Mr. Chairman.

Representative HOLIFIELD. Senator Dworshak.

Senator DWORSHAK. Mr. Fields, I should like to call your attention to the total amount of AEC financial assistance of $29,341,000. Experience at Shippingport and elsewhere has shown that invariably the cost of constructing these nuclear powerplants is much higher than the original estimates. Let us assume that in this case the proposers find that it is necessary to spend a lot of additional money beyond their estimate. Will AEC expand its participation also, or is this $29 million the ceiling so far as financial aid by AEC is concerned?

Mr. FIELDS. It is proposed as a ceiling in this contractual arrangement, yes, sir.

Mr. RAMEY. You have one option to increase the amount.

Mr. FIELDS. Perhaps Mr. Diamond should speak to this. It is an option at the end of phase I if feasibility has not been determined

and we mutually agree additional research and development would be entered into. But that would be a separate agreement, sir. In this actual arrangement these are ceiling amounts.

Senator DWORSHAK. I am interested primarily in finding out and placing in the record whether AEC will be called upon later to make additional grants available. I think there may be some justification for AEC having access to this research and development, but on the other hand I think some safeguards should be adopted so that the Government will not be placed in an embarrassing position later if there should be some unforeseen developments which materially increase the cost of this particular plant.

Mr. FIELDS. It would have to be that we would agree to do that, sir. We are not obligated. We would have to have additional authorization. We would have to come to this committee again.

Representative VAN ZANDT. You would have to come back to this committee.

Mr. FIELDS. Yes, sir; it would be a material change in the arrangements.

Senator DWORSHAK. Do you know what the cost of this power will be?

Mr. FIELDS. We estimate approximately $29 million of Atomic Energy Commisison assistance.

Senator DWORSHAK. I mean the cost on the basis of kilowatts.

Mr. FIELDS. I will have to ask Mr. Davis to give the cost per kilowatt.

Senator DWORSHAK. How will it compare with the cost of power developed at Shippingport.

Mr. DAVIS. I wonder if perhaps the Westinghouse people would like to answer that since I have not divided it out.

Representative HOLIFIELD. Dr. Johnson, would you hazard a guess?

Mr. BUSBY. Since we are going to be the owner and operator of the plant, Mr. Holifield—I think you used the right word when you said guess, we don't know as much as we would like to—we have estimated, and we have had the advice and guidance of Stone and Webster architect-engineers in terms of cost analysis and so on, $57 million capital cost. Taking a look at our operating situation without regard to the effect of the waiver of fuel charges or waiver of heavy water, which is worth $5 million in the first 5 years, we think that an average power cost over the assumed 20-year life of the plant would be 9.3 mills per kilowatt-hour. Some very important assumptions are involved in that.

One is that the plant would operate at 80 percent capacity factor.

Representative HOLIFIELD. Are you figuring the 70,000 kilowatts or 150,000 kilowatts?

Mr. BUSBY. That is 150,000. Certainly the power costs would be higher if it were a smaller plant. We have made certain assumptions as to the effectiveness of our contemplated remote maintenance procedures. We have assumed, generally, in other words, that the plant would work. Those are the power costs that we got.

Senator DWORSHAK. What is the significance of point 3 operation, that the Pennsylvania Power & Light Co. will operate for 5 years as part of its power system?

Mr. BUSBY. I think that is a normal provision in contracts of this kind to insure that some operating experience will be obtained which will justify the AEC research and development assistance.

Mr. FIELDS. There will be obtained research and development information and information vital to the evaluation of this reactor during such an operating period.

Senator DWORSHAK. It is assurance to the AEC that during the 5-year period you will have access to the operating feasibility of this type of plant.

Mr. FIELDS. That is correct.

Senator DWORSHAK. I have one more question. Is that part of your contract, this 5-year operation?

Mr. FIELDS. That is part of phase II; yes, sir.

Senator DWORSHAK. Can the company terminate that provision in the contract?

Mr. FIELDS. I will have to ask the General Counsel whether they can terminate during the 5-year operating period.

Mr. DIAMOND. They don't have the right of termination during the operating period. After they have obtained their license and insurance coverage.

Senator DWORSHAK. In other words, AEC has absolute assurance that for 5 years the results of the operation will be made available to the Government.

Mr. DIAMOND. That is correct, sir.

Senator DWORSHAK. General Fields, what is the cost of generating power per kilowatt-hour at Shippingport? Has that become a firm amount?

Mr. FIELDS. I don't believe it has become a firm figure as yet, sir. It is considerably in excess of the figure that Mr. Busby indicated.

Senator DWORSHAK. I have heard many conflicting amounts or estimates as to the cost of that power. It seems to me that at some point in all of these deliberations that AEC should determine the precise cost of power. I realize that Shippingport is operated by a private utility and probably it is no business of AEC. But if there is to be some determination or experience based on practical results of operating these nuclear powerplants, then I think the AEC should know as well as Congress the cost of this power as compared with the cost of conventional power. I don't think that is unreasonable, do you?

Mr. FIELDS. I think it is very reasonable.

Representative HOLIFIELD. Senator, for the benefit of the record, while the Duquesne people are operating it, they are operating it under contract and the AEC has a right to all of the research and development information that has accrued during the operation of it. So it is a matter of right for the Government to have that, and we will have it.

Senator DWORSHAK. It seems to me as we project the possible competitive position of nuclear generated power that at some point we ought to know how competitive it is with the cost of conventional power.

Representative HOLIFIELD. I am sure those figures are being very carefully looked at and as soon as they are available, we will have them.

Mr. DAVIS. Mr. Holifield, we are working out quite detailed accounting procedures for the plants which are in existence. The Army package power reactor at Fort Belvoir and the PWR. So we will be able after these plants are run for some time to present figures on

what the actual cost of producing power has been. Of course, in all of these cases we also make estimates of what we think the power cost is going to be. In the case of Shippingport we recently put out some information which estimates 64 mills for the first core, and for the initial operation. But in a matter of a year or so we should have some actual verified kinds of cost records which can be used to present quite detailed information on this point.

This is part of what we get out of these operating periods.

Senator DWORSHAK. Mr. Davis, one final question. The AEC belives that all of the research and development work done at this proposed construction will be available to AEC and that justifies the participation on the basis of financial aid.

Mr. DAVIS. This information will be available not only to the AEC, but to all of the people who are interested in this type of reactor or related types. In other words, it will be distributed generally through the AEC system for disseminating information.

Senator DWORSHAK. There will be no conflict with the work which currently is being done at Oak Ridge on this kind of project.

Mr. DAVIS. No, sir. They have worked very closely together. From my discussions with the Oak Ridge people they feel this is a very worthwhile project which complements what they are doing and aids it very substantially.

Representative HOLIFIELD. Actually it is an extension and extrapolation of their work to a certain extent.

Mr. DAVIS. It is going off in the kind of way that is expressed by the words that Senator Anderson read, of doing something that we can do now which does not have as high goals, it does not have to be a breeder, it doesn't have to be the ultimate reactor, but will still be a very good one. As I said in my opening statement, it is byproduct of the work which is being done at Oak Ridge. The Oak Ridge people feel as a national laboratory they would like to concentrate their efforts on the ultimate kind of nuclear powerplant and not on the byproducts that may come as a result of having directed their efforts toward the best possible nuclear powerplant they can foresee in the future.

Representative HOLIFIELD. Mr. Durham.

Chairman DURHAM. I have just one question, Mr. Chairman. Since, of course, this is a kind of three-way contract with the Westinghouse people and the Pennsylvania Power & Light and the Commission, I would like to know for the record how the recommendation was made, and whether or not Dr. Johnson made the recommendation on the 2-year extension direct to the Pennsylvania Power & Light Co., or did the AEC make it? How was it made? Mr. Busby, I suppose, was looking for real information as to whether or not this thing was ready to go. Was it made in writing, Dr. Johnson?

Dr. JOHNSON. About the middle of 1957 we made a rather detailed technical evaluation within the power project—which is almost a separate entity—as to where were we and what was the status of our particular project.

Chairman DURHAM. Then you did assume the responsibility by advising the Pennsylvania Power & Light Co. that this thing was not prepared to go ahead at the present time.

Dr. JOHNSON. I believe that I submitted to Mr. Townsend, who was the Pennsylvania Power & Light Co. representative, and Mr. Wells, the Westinghouse Co. representative, a letter outlining 3 or 4 areas where it was not clear that we could proceed. These areas were essentially the areas that I repeated here a few moments ago.

Chairman DURHAM. I do not care about discussing it. You either made a recommendation, yes or no.

Dr. JOHNSON. Yes.

Chairman DURHAM. You made the recommendation.

Dr. JOHNSON. Yes; I did.

Chairman DURHAM. Did the AEC make any recommendation whatever on this matter?

Mr. DAVIS. With respect to the choice?

Chairman DURHAM. Naturally it had to come from the contractor or the AEC.

Mr. DAVIS. We certainly made no recommendation that they pursue the homogeneous reactor or that they pursue this particular type.

Chairman DURHAM. The question of delay has come into this picture. It is important I think for someone to assume the responsibility as to who made the recommendation. I have great respect for Dr. Johnson's knowledge.

Dr. JOHNSON. I believe I can say I made the recommendation of not proceeding at this time.

Chairman DURHAM. Was that made to you in writing, Mr. Busby, or do you recall?

Mr. BUSBY. We have not found it necessary to be that formal. We have a program here of almost daily checking and conversation and review. Within our engineering department we have what we call an atomic power division. Mr. Townsend is the head of that. Mr. Townsend and I and Mr. Weaver and Dr. Johnson talk about these things day in and day out.

Chairman DURHAM. I know you do, but you have to make a decision in these matters and a corporate company like yours likes to have specific recommendations when you are investing $50 million or more.

Mr. BUSBY. What we did was on an informal basis of discussion and information we reached a common point of view, namely, that we had to find out more about this matter before we were ready to build the plant. Then we said, how long will it take, how much money will it cost. We asked Dr. Johnson and his crew to address themselves to the proposition, what kind of a program do you need to get the information that you should have before you make the commitment on building the plant.

Chairman DURHAM. Westinghouse made the recommendation.

Mr. BUSBY. They came up with the program and that program is essentially with minor modifications the program for the 2-year, 1958–59 research development.

Chairman DURHAM. I have great respect for them because they have a great deal of knowledge in this field.

Representative HOLIFIELD. The Chair will announce that this room is unavailable for the afternoon. We will meet in room 1334 of the New House Office Building. We will try to meet at 1:45.

AFTERNOON SESSION

Representative HOLIFIELD. The committee will be in order.

STATEMENTS OF K. E. FIELDS, GENERAL MANAGER; W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT; AND EDWARD DIAMOND, GENERAL COUNSEL, ATOMIC ENERGY COMMISSION—Resumed

Representative HOLIFIELD. Mr. Fields, I have a few questions that I want to place on the record. Back in 1951 or 1952, did not the AEC seriously consider bringing in an industrial contractor to develop and construct the prototype homogeneous reactor on a cost-type basis?

Mr. FIELDS. I cannot answer that, Mr. Chairman. I don't know.

Representative HOLIFIELD. Mr. Davis, were you here then?

Mr. DAVIS. No, sir, I was not, Mr. Holifield.

Representative HOLIFIELD. How about Mr. Diamond?

Mr. DIAMOND. No, sir, I was not here at the time either.

Representative HOLIFIELD. Mr. Tammaro, come forward.

Mr. TAMMARO. I was in the field at that time, Mr. Chairman. I was not in the Washington office.

Mr. RAMEY. Didn't the Chicago office participate in a contract board to consider an industrial contractor for a homogeneous reactor project? John Flaherty was chairman of it.

Mr. TAMMARO. Jim, you will have to refresh my memory. You were there.

Mr. RAMEY. For the record, I believe there was a joint board established by the Division of Reactor Development consisting of representatives of the Chicago office and the Idaho operations office, whose task was to make a recommendation on an industrial contractor to develop and construct a homogeneous reactor on a cost-type basis. My recollection is that this board made recommendations with Phillips Petroleum as the main recommendee and also American Cyanamid. This report was submitted to the General Manager and nothing happened. That is my recollection.

Perhaps the committee might be given a copy for the record of the Board's recommendation and record. And also an explanation as to what happened to those recommendations.

Mr. DAVIS. Mr. Chairman, I have a chronology here which is part of our records which does give some of the early history of the homogeneous reactor experiment No. 1, if this would be of some interest.

Mr. RAMEY. This was to take off from the homogeneous reactor No. 1 and bring in an industrial contractor to work with your laboratory type of contractor, following the normal established procedures used by the Commission at that time of having an industrial contractor, such as Westinghouse, picking up on the actual prototype construction, the same way they did, say, on the Shippingport reactor.

Mr. FIELDS. Mr. Chairman, we will provide an answer for the record on that.

(The information referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., April 17, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation of the Joint Committee on Atomic Energy, Congress of the United States.

Dear Mr. HOLIFIELD: This will provide information concerning the selection during 1951–52 of an industrial contractor for the development and construction of a prototype homogeneous reactor for the production of plutonium and power, as requested by your committee during the March 22 hearings on the Pennsylvania Power & Light-Westinghouse power demonstration reactor project.

In June 1951 an AEC Washington Contractor Selection Board was established to select an industrial contractor for participation in the ORNL homogeneous reactor project and to serve as the development, construction, and operating contractor for a large prototype homogeneous reactor for the production of plutonium and power. This action arose out of optimism concerning the ORNL program to date combined with the desire to broaden industrial participation in developing reactor types promising to contribute to AEC programs for the production of fissionable materials as well as electric power. A large number of firms in the chemical and petroleum manufacturing industries were approached during October 1951. Nine of the companies indicated interest and were provided with background information on the homogeneous reactor program on a classified basis. Four of the companies finally submitted written proposals.

A Homogeneous Reactor Review Committee, under the direction of the AEC Chicago Operations Office, carried out the contacts with the industrial firms, reviewed the proposals received, and, in January 1952, determined that two of these, from American Cyanamid Co. and Phillips Petroleum Co., met the selection criteria.

The AEC Washington Contractor Selection Board reviewed the report and recommended in February 1952 that contractual discussions be held with the two companies recommended for consideration by the Review Committee and that final selection then be made on the basis of the most advantageous contractual arrangements.

During the period of contractor selection, June 1951 to Febraury 1952, a number of changes occurred in the Commission program for civilian power reactors. These culminated in the formulation of the 5-year program and the assignment of a lower priority to the prototype dual-purpose homogeneous reactor project. The contractor selection process, therefore, was abandoned and the AEC homogeneous program reoriented accordingly.

Sincerely yours,

R. W. COOK,
Deputy General Manager.

Representative HOLIFIELD. I thought we ought to have that on the record, because this has been a matter of consideration since way back in 1950. We are still a long way from having an operating reactor.

The provisions that occur under this proposal as well as the proposal of the Florida people which we considered a few days ago require a basic change in the act, do they not?

I would like to have an explanation on the record at this time. In other words, you are not just presenting us with a proposal for the benefit of the committee's knowledge, but you are also presenting, and the legislation presented pertaining to this, a basic change in requirements under the third round.

I would like to have an explanation of that, please, for the record.

Mr. FIELDS. We proposed a change that would permit the waiver of the use charge on heavy water and on the completion date. Well, let me get these separated. The change with respect to the waiver on the heavy water that we requested was presented to Congress here just recently, and we appeared a week ago Friday on that, to change and allow that to be a condition of the third round.

Representative HOLIFIELD. In other words, you are increasing the third-round benefits by making available the heavy water?

Mr. FIELDS. If that does not go forward, however, that is not a condition of this proposal.

Representative HOLIFIELD. Do you mean if the basic legislation is not passed?

Mr. FIELDS. If the basic legislation is not passed on that point, this proposal would still go forward, in that it is requested that that kind of assistance could be applied to this proposal if it is adopted by the Commission, or if it is approved and authorized by the Congress.

Last summer we requested that prior to the authorization bill that was passed, and came forward with the indication of the change in date on the homogeneous reactors that we wished to be applied to the third round.

So I do not believe there is a basic change in the law necessary for this proposal to proceed, Mr. Chairman.

Now, as we indicated, later on we are requesting the phase 2 authorization in conjunction with fiscal 1959 authorization.

I don't believe an authorization is exactly the same as you had in mind, a change in the law. I am not sure, Mr. Chairman, how you would interpret it.

Representative HOLIFIELD. The change in the law which was requested was to make it possible for you to give——

Mr. FIELDS. A waiver on heavy water charges.

Representative HOLIFIELD. A waiver on heavy water.

Mr. FIELDS. Yes. But it is clear in this proposal that if that cannot be provided, this proposal is still to go forward.

Mr. RAMEY. It could be utilized if the law is passed?

Mr. FIELDS. It could be utilized, and we would intend to if the law were passed. It is not mandatory, but I think we would intend to. We would have the authority to do so.

Mr. RAMEY. One further question on whether the proposal conforms with the third-round invitation. Do you think this conditional research and development aspect of the project, where either party, and particularly the other party, can terminate its participation at any time during phase 1 up to the end of phase 1 and not going into construction, is consistent with the intent and meaning of the third-round arrangements?

In prior projects approved there was normally a commitment on the other party to go ahead with the construction of the reactor.

Mr. FIELDS. Well, I have interpreted it that it meant the criterion of the third round in that although there are conditions upon proceeding with construction, nevertheless there is an undertaking under certain circumstances to proceed with construction.

Mr. RAMEY. That would be the case, say, in the Florida arrangement, where they say that they are obligated to go ahead with construction if the cost isn't more than 50 percent of their original estimate.

Mr. FIELDS. That is true. It is a different obligation here in that if it is determined to be feasible, yet they determine not to proceed, they then refund the expenditures of the Government to that point.

Mr. RAMEY. Is there any obligation to proceed, from a legal standpoint?

Mr. DIAMOND. There is either an obligation to proceed after determining the feasibility or to refund the money that the Commission paid under the first phase.

Representative HOSMER. Would you consider that a compulsion to proceed in light of the $7 million obligation?

Mr. DIAMOND. I would think so.

Senator ANDERSON. But you are not the one to do it. Wouldn't the Pennsylvania Power & Light be the one that would have to answer that question?

Would you consider it compulsory to proceed, Mr. Busby?

Mr. BUSBY. Senator, I think it comes down to the intent, really, that we have in going into this. Our intent is to build this plant if it is not imprudent to do so. We are going to be faced with a decision of this 2 years of research and development, and we are going to have to weigh our knowledge then as to what this plant will cost. We estimate it today at $57 million. Two years of research could change that. We will have to appraise what we think the operating performance of the plant is going to be, what coal costs are going to do, what it is going to cost in manpower, all of those things in terms of cost burdens, and we are also going to have to weigh the cost burden of refunding, with Westinghouse, the $7 million.

I would not say that we are under a legal compulsion to go ahead at the end of 1959. We have tried to make it quite clear that we have not jumped the gun on this. We are going to make the final point of no return decision at the end of 1959, not now. But we are going to try to make it with the idea, if we can, within the considerations of prudence of building this plant.

Senator ANDERSON. If, by any chance, during the 2 years, you should develop a process that is patentable and highly valuable, could you not say "We decline to go forward with the contract," and pay the $7 million, patent the materials and be in pretty fair shape?

Mr. BUSBY. You posed the question. I suppose that is right. I hadn't thought of it in any such Machiavellian way.

Senator ANDERSON. I don't think it is Machiavellian to examine your commercial possibilities?

Mr. BUSBY. Well, we have no interest in the patent situation here at all.

Senator ANDERSON. But if you developed something that was patentable and Westinghouse agreed with you that it was highly desirable, that it would put them in a tremendous advantageous position, vis-a-vis the rest of the industry, you could pay the $7 million to the Atomic Energy Commission and say "We do not choose to go ahead. We choose to patent." Couldn't you?

Mr. BUSBY. I think under the arrangements that exist, the Commission gets a royalty-free license with respect to any patents that are developed even though we pay the cost of the 1958–59 program.

Senator ANDERSON. So all of the plants the Commission build they would have royalty free. But how about the rest of the industry?

Mr. BUSBY. I can't imagine really as a practical matter in this field that a patent is of any value until it is proven. I don't see how you can prove a patent until you build a plant.

Senator ANDERSON. Nobody has applied for any patents in this field?

Mr. BUSBY. Pennsylvania Power & Light Co. has no stake in the patent situation.

Senator ANDERSON. Mr. Weaver, does Westinghouse have any stake in the patents?

Mr. WEAVER. Senator, we definitely have a stake in patent affairs, obviously. The history of the program to date, and the expenditure of the $5.5 million through 1957, is that there have been no patents granted under that program.

There are some patent disclosures which have been filed, perhaps of questionable value. We don't know whether there are going to be patents or not or what the value of those patents might be. Certainly what you suggest might be a decision that we would take during this 2-year period as something we might do.

But I can only assure you that we have never even thought of it until this moment. In other words, it hasn't entered into our consideration of the 2-year program whatsoever.

Senator ANDERSON. Do you mean it just dawned on me instantly but didn't dawn on you at all?

Mr. WEAVER. Senator Anderson, we have not considered any patent position in trying to advance this particular reactor type and get on with the job.

Senator ANDERSON. But you do admit that the contract is subject to that possibility?

Mr. WEAVER. Yes. But, again, I would like to emphasize that the Commission, the Government, will have a royalty-free license.

Senator ANDERSON. For whatever they make. It is like giving me a royalty-free license to make copies of the *Nautilus*. I probably wouldn't build a single *Nautilus* in my lifetime. So what value is it to have this royalty-free basis?

Just outline that to us, will you, please?

Mr. WEAVER. The Government is in a position to use that royalty-free license for the construction of a plant to which it will have title. I am not a patent expert, but I certainly understand that.

Senator ANDERSON. How many plants has the Government been authorized to build within the last 3 years to which it will have title?

You are right in the business. Shippingport was started under the 1946 law. But since the passage of the 1954 law, how many plants is the Government building to which it will have title?

Mr. WEAVER. Senator, I am not in a position to evaluate that.

Senator ANDERSON. We are trying to evaluate what this patent-free business is worth. Is it worth anything at all in your opinion?

Mr. WEAVER. Yes.

Senator ANDERSON. What plant do they ever build, do you think?

Mr. WEAVER. This might be applicable to something other than civilian power. It could be some other phase of atomic power or atomic energy, which is a direct interest to the Government.

Senator ANDERSON. In connection with the $5.5 million that has been spent, how many patent applications have you filed so far?

Mr. WEAVER. Senator, I did not come prepared to answer such a question, but it is in the nature of a half dozen, perhaps, disclosures filed but no patents granted.

Senator ANDERSON. When you have a disclosure filed, does that put you in a pretty good position for the filing of a patent?

Mr. WEAVER. Providing it is patentable.

Senator ANDERSON. That is nearly as valuable as a patent, is it not, if it proves to be patentable?

Mr. WEAVER. Yes.

Representative HOLIFIELD. Will the gentleman yield there?

Senator ANDERSON. Yes.

Representative HOLIFIELD. I just want to ask this one question: Would you be willing to forego any of the rights to file for patent protection on the $7 million which the Government will spend in phase 1?

Mr. WEAVER. For phase 1, Mr. Chairman, we have proposed the identical patent arrangement, and this is what has been discussed with the Commission as a basis for their approval of our proposal. We have under the Yankee development contract——

Representative HOLIFIELD. Isn't that a different situation?

Is the Atomic Energy Commission doing its research and development work in its own laboratory for the Yankee Atomic, or is it doing it with contract by your people?

Mr. WEAVER. As a matter of fact, that developing work is being done by the same organization which is doing this work, our atomic power department, which is a Westinghouse-owned facility, in contrast to this.

Representative HOLIFIELD. Now to put a specific question: In the case of the expenditure of the $7 million, the AEC will actually expend that in your laboratories, is that not right?

Mr. WEAVER. Yes, that is right.

Representative HOLIFIELD. In the case of that expenditure, the AEC will not have equity rights, basic equity rights, in any patentable techniques or processes that are developed during that time—when I say basic, I mean so that they can make it free to all the industry—if you pay back the $7 million, is that right?

Mr. WEAVER. That is right. You would just have the license in that event, a royalty-free license.

Representative HOLIFIELD. In case the Government spends this $7 million, and it is not paid back, they will have the basic rights then?

Mr. WEAVER. The Government will have the full rights.

Representative HOLIFIELD. Would they be free at that time, as free to announce that they do not intend to accept the $7 million as you would be free to say that you want to pay the $7 million?

Would they be in an independent position then, or would there be contractual obligations on their part to sell to you the benefit of their research and development for the $7 million they put in?

Is this a one-way street, in other words? Is it a one-way street that they do not have the right to withhold?

Mr. BUSBY. Mr. Chairman, I do not think the point ever came up in the negotiations. I appreciate the point you are raising. As far as we are concerned, there would be no objection at all to giving the AEC the option not to be paid back the $7 million, if that option is one that they wanted to add.

Senator ANDERSON. That isn't anywhere in these proposals, as I read them.

Mr. BUSBY. Concedingly, Senator, I said the question never came up.

Senator ANDERSON. This is just like a Marquis of Queensbury prize fight. You protect yourself at all times, don't you?

Mr. BUSBY. Mr. Chairman, we want this proposal to have fair and proper terms to it. If there is any question about amending it to meet that point, we want to amend it.

Senator ANDERSON. Yes, but you will agree that the way it was drawn up between the AEC and yourselves, you had the option to buy the patent rights and they did not have the option to refuse.

Mr. BUSBY. I will agree to that, sir. You will have to take, if you will, our word for it, that in our working out of this thing patent rights were never thought by either Westinghouse or ourselves as having any value. We were thinking of $7 million, however, as having a lot of value, but not patent rights. The point, however, has been raised, and we want to resolve it in a way that is fair and proper.

Senator ANDERSON. What about the first $5.5 million?

Do you have any comments, General Fields, on this point?

Mr. FIELDS. I will ask Mr. Diamond.

Mr. DIAMOND. With respect to the $5.5 million?

Senator ANDERSON. I am talking about the right to purchase. Suppose they spent $3 million and decided to quit, but they hit something that is a real gold mine as far as patentable items are concerned. Could they quit then and give you this $7 million and say "The partnership is over. We have it." Couldn't they do that?

Mr. DIAMOND. I think the way this is written, they could, yes, sir.

Senator ANDERSON. When you were drawing it, you didn't feel that the AEC needed anything on that point?

Mr. DIAMOND. I did not sit in on the negotiations, but I will accept the responsibility.

Senator ANDERSON. I do not want people to accept the responsibility. We ran into that in the House of Representatives one time on Dr. Libby's letter.

Mr. DIAMOND. I am sure this was an oversight or wasn't appreciated. But I agree with the point that has been made here.

Senator ANDERSON. Now go to the $5.5 million. We all agree that whatever is developed under the $5.5 million belongs to Pennsylvania and Westinghouse, do we?

Mr. DIAMOND. That is correct, sir.

Representative HOLIFIELD. Senator, may I interrupt there to say that under the proposal, if we are going in to phase 2 and spend the additional $18 million or $22 million, whatever the case may be, there, again, you will have the position of the AEC unprotected as to sole rights to the research and development that will be spent under that phase.

Is that not true?

Mr. FIELDS. Do you want to answer that, Mr. Diamond?

Mr. DIAMOND. With respect to the second phase, as I understand the arrangement on the second phase, insofar as patents are concerned, we would get all patent rights in connection with the research and development that we support.

Representative HOLIFIELD. Are you sure of that?

Mr. DIAMOND. That is correct, sir.

Representative HOLIFIELD. It is not in line——

Mr. DIAMOND. There is one modification I should like to mention.

Representative HOLIFIELD. It is not in line with the proposal. It is not provided for in the proposal. I think you would find yourself

in the same condition there as you find yourself in now on the $7 million, that you have not protected the rights of the taxpayers in making a specific provision for complete rights to them. We are in this position: What you are essentially asking for is $30 million for research and development. This committee is in favor of research and development.

And it has supported, as you know, a large program in research and development.

But we do feel that when we spend the taxpayers' money for research and development, we must protect the rights of not a mythical thing called the Government, but the rights of all American industry to have free access to that particular information.

That is who we are really protecting. We are not protecting a mythical thing called Government. We are protecting the balance of American industry to have free access to that technology which has been paid for out of the public funds.

This is our concern at this time. This is a very important concern.

Mr. DIAMOND. Mr. Holifield, as I understand the proposal, in connection with the research and development that the Commission pays for, and I am talking about the $18 million in the second phase, the Commission will have the rights to all inventions made in the field of atomic energy, with the Westinghouse people getting a royalty-free, nonexclusive license.

Representative HOLIFIELD. Well, that is responsive, if you have that protection in your contract.

Mr. DIAMOND. There is no arrangement, so far as I understand it, for their returning money to us under the second phase. So there can't be any revesting of patent rights in the Westinghouse or in the Pennsylvania Power & Light people.

Mr. RAMEY. On the power research and development, this amount financed by the $5 million, isn't it normal for the Commission in its ordinary research and development contracting to go back and try to pick up the patent rights that the other party has on prior research and development so that the Commission is in a position when it is financing the work not to pay royalties or to have industry pay royalties on the further improvements on that development?

Mr. DIAMOND. Mr. Ramey, if we were going to reimburse them for the $5.5 million, I agree with you, we would go back and ask for patents that may have been developed during that period.

But since we are not going to reimburse them for that $5.5 million, I don't know that our equities are quite that strong.

Mr. RAMEY. Yes. But isn't it a practice of the Commission as a consideration for paying for the later research and development, to pick up prior patent rights?

For example, in zirconium contracts, didn't they pick up some of the past patents of carborundum, for example, and doesn't the Commission, as just a normal contract practice attempt to negotiate that type of arrangement?

Mr. DIAMOND. Based on my recollection, I think what we tried to negotiate under those circumstances would be royalty-free license to use for governmental purposes.

Representative HOLIFIELD. Was that the case in zirconium?

Mr. DIAMOND. I think that is so, although my recollection is a little dim on that.

Representative HOLIFIELD. Will you give us a letter on that point, please?

Mr. DIAMOND. All right, sir.

(The letter referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., April 10, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation,
Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. HOLIFIELD: In the course of the hearing conducted by your subcommittee on March 22, 1958, concerning the proposed arrangement No. 58–111–6 between AEC and Pennsylvania Power & Light Co.-Westinghouse Electric Corp., you requested that you be informed as to the provisions included in our contracts for zirconium covering the Government's rights to patents developed by the contractor prior to the AEC contract.

Under the terms of article 13 of contract No. AT (11–1)–223 with Carborundum Metals Co., Inc., dated May 13, 1952, the Government received a nonexclusive, irrevocable, royalty-free license under any invention or discovery previously owned by Carborundum or thereafter acquired outside the course of work under the contract and pertaining to the work called for in the contract and dominating any invention or discovery made or conceived by Carborundum in connection with the contract work. This license was limited to the right to make, have made, use and sell for governmental purposes.

Article XIX of contract No. AT (11–1)–404 with the Carborundum Metals Co., Inc., dated April 30, 1956, provides that the Government will have an irrevocable, nonexclusive, royalty-free license under any invention or discovery made or conceived by Carborundum under the contract and relating to the production of zirconium, hafnium, uranium or thorium, limited to the right to make, have made, use and sell for governmental purposes. In the event that AEC takes over operation of the plant after a default, the Government is also given a similar license for such operation under all inventions, discoveries, applications for patents and patents incorporated or used in the operation of the plant to the extent that Carborundum has the right to grant such a license without obligation to pay royalties to another. Contract No. AT (11–1)–391 with Columbia National Corp. and contract No. AT (11–1)–389 with National Distillers Corp. contain similar patent provisions.

In contract No. AT (11–1)–472 with Wah Chang Corp. for the supply of zirconium resulting from operation of the Government-owned plant at Albany, Oreg., the Government received a nonexclusive, irrevocable, royalty-free license in all inventions, discoveries, patent applications or patents of the contractor incorporated or used in the operation of the plant for the purpose of its continued operation by or for the Government. The contractor further agreed to grant licenses in such inventions to third parties for commercial production from the same plant from which they have contracted to furnish zirconium to the Government, where the production for the Government constitutes the major portion of that plant's output, at fair and reasonable royaly rates no higher than commercial rates then in effect for the same type of process or material.

This review confirms Mr. Diamond's recollection that AEC has not acquired from any zirconium supplier the ownership of any patents or inventions made or owned by the supplier prior to the date of its contract with AEC.

Sincerely yours,

R. W. COOK,
Deputy General Manager.

Mr. RAMEY. The further question would be: Wouldn't it be desirable for the Government to pick up as part of this arrangement, at least for governmental purposes, any patents that may have been filed during this prior research and development phase, financed by the $5 million?

Mr. DIAMOND. I would think it would be desirable to get it if we could.

Representative HOLIFIELD. You are about to spend $30 million on a research job, where $5 million has been spent, and you are making

a firm commitment for $7 million and a tentative commitment for some $22 million more.

You are in a position of the benefactor rather than the beneficiary, are you not, as far as research and development in this particular field is concerned?

These people come to you seeking $30 million to do a job on which they have now thrown their hands up and said they couldn't do and which they said before they could do by themselves. That is the record. Mr. Oakes said "We don't want the Government to intervene. We are ready to do the job."

Now his successor, Mr. Busby, and his affiliates, come to us and say "We have changed our mind. We want $30 million." Let's see that it is not a one-way street.

Senator ANDERSON. Mr. Busby, to come to the testimony given 2 years ago when Mr. Oakes was testifying in May–June 1956, we were discussing whether there was any financial incentive. In order to give you some background, I did say "But you do recognize, Mr. Oakes, that there is no great spur for the development of atomic energy in the United States because of the very successful operation of conventional fuels."

Mr. Oakes said "Yes."

I said "The financial spur is not there, is it?" And he said:

> Yes, it is. We cannot think of our economy in industries in terms of 2, 3, or 4 years. We are now, all of us, looking forward to some competitive type of power and we are, all of us, leaders in this industry, perfectly willing to spend a reasonable amount for research, put money on research and development to achieve that objective.

You spent $5.5 million. This next procedure, the second phase, is $7,300,000. How much is Pennsylvania going to spend on research in that phase?

Mr. BUSBY. Well, our liability with respect to reimbursing the Commission out of the $17 million. The phase 1 part, is 50 percent, Westinghouse taking the other half. Baltimore Gas & Electric has joined the program, but their participation, while substantial, is nowhere near as great as either Westinghouse's or ourselves.

Senator ANDERSON. I understand that. My question, if you misunderstood it, was: Having spent $5.5 million, if the Commission picks up the tab on the first phase of $7,300,000, how much is Pennsylvania going to spend of its putting money on research and development that Mr. Oakes was talking about?

Mr. BUSBY. Well, I don't know whether your question is limited just to the 2 years, Senator, or to the project.

Senator ANDERSON. I will get there. I am just asking about the $7,300,000 now. Does Pennsylvania contemplate spending any of that, if the Commission picks up the tab?

Mr. BUSBY. If the Commission picks up the check for the phase 1 program, 1958–59, there will be some expenditures over and above what the Commission will pay for, but they will not be substantial, and those will be shared by Westinghouse and ourselves. Our contribution will only be operative in the event that the reimbursement provisions apply.

Senator ANDERSON. Reimbursement provisions don't apply if you mutually agree to quit, do they? Based on the Dixon-Yates experi-

ence, most of us agree that you would mutually agree to quit, regardless of whether the Government ordered the contract stopped or not.

Mr. BUSBY. May I say that the contract provides this on that point, that if we decided we wanted to stop, we would pick up the check and the costs. The only basis on which the program can be stopped, and we will not have to reimburse, is on, really, a finding by the Atomic Energy Commission that the project is technically infeasible.

Senator ANDERSON. That would be the only reason you would want to quit, wouldn't it?

Mr. BUSBY. If we decided and they decided it was technically infeasible, I think it would be prudent to stop; yes, sir.

Senator ANDERSON. Now we come to the second phase, which is composed of several parts, $18,330,000 for research and development. How much of that will Pennsylvania Power & Light put up?

Mr. BUSBY. The situation there is substantially the same as with respect to the $7 million for 1958–59. That is, there probably will be some costs necessary in connection with that program over and above what AEC would provide. But we wouldn't expect them to be substantial.

Senator ANDERSON. I guess phase 2 probably is $15,290,000, and the rest of it is postconstruction costs, which also says phase 2, research and development, $3,040,000. When you add the 2 of them together, it makes $18,330,000 for research and development.

Mr. BUSBY. That is correct.

Senator ANDERSON. What about the $4,011,000? That is purely a Government contribution to the project?

Mr. BUSBY. Yes, sir.

Senator ANDERSON. Excuse me. Does that also include the heavy water?

Mr. BUSBY. $4 million does not.

Representative HOLIFIELD. It would be another million dollars, then, that is not in the proposal list here for heavy water.

Mr. BUSBY. Yes, sir.

Senator ANDERSON. $950,000, I believe.

Mr. BUSBY. Senator, could I add a comment about the research and development?

Senator ANDERSON. Surely.

Mr. BUSBY. You might well say that our research and development contribution which we have always contemplated in this project is being deferred insofar as the AEC puts up money for 1959 and further puts up the phase 2 research sum that you mentioned.

But as we discussed this morning, the power costs that we expect under good conditions of operation are not going to be competitive power costs.

Somebody is going to have to pick up the check for the excess cost of the nuclear power from this plant over and above conventional power costs. We, in effect, are saying here, "We are conserving, if you please, the money we are prepared to put up in the name of research and development to apply to meet this cost burden, and, thus, give it a reasonable prospect of financial feasibility."

I would not have you think that we are in any way running out on a research and development contribution to this problem. We are not.

Senator ANDERSON. Is there something in the contract that says that in case $7,300,000 is spent, and that then $15 million or $18 million more is spent, that you have to put in a contribution?

Couldn't the Atomic Energy Commission at that time decide what it did in the Shippingport case and let you have the power at cost, the cost of competitive fuels?

Mr. BUSBY. I suppose that the general rule would apply, namely that any person is free to agree to a new arrangement. But, of course, as was discussed this morning also the Government would not be in a position to put any more money into this project without the concurrence of this committee.

Senator ANDERSON. Is the Government bound not to ask for any more? Is it a firm contract that you will take care of all of these costs over and above conventional power costs?

Mr. BUSBY. The contract is firm that the maximum obligation of the Government in this program is $29 million, with the possibility that the heavy water would enter into the situation and that would be another million dollars. It is also true that we do say we reserve the right to ask, but there is no obligation on the part of the Government to grant.

Senator ANDERSON. No; but you left ourself open to get the same sort of deal you got at Shippingport.

Mr. BUSBY. Well, we didn't have that in mind.

Senator ANDERSON. I don't follow you on the "We don't have it in mind" sort of thing. In any financial transaction, don't you always examine what the possibilities are?

Mr. BUSBY. We didn't have in mind at all a Shippingport type of transaction; no, sir.

Senator ANDERSON. I don't know whether you should comment on this or Mr. Fields. But in the letter which the Chairman of the Atomic Energy Commission sent to Chairman Durham on February 24, it reads:

> The proposal, as you may recall, covers the research and development, design, construction and operation of a single region slurring homogeneous type reactor in the size range of 750 megawatts on the system of the Pennsylvania Power & Light Co. The company estimates completion of the plant by about December 31, 1963; the proposal contemplates AEC assistance of about $7 million for preconstruction research and development, to during the construction and operating phase, and the waiver of U–235 and U–233 use charges.

Mr. FIELDS. Senator, I am following the same letter. You left out $18 million for research and development.

Senator ANDERSON. You come and find it. That is just what I am getting to.

Mr. FIELDS. I have a copy of the February 24 letter.

Senator ANDERSON. All I know is I am like the rest of you, only what I read. They didn't send me a copy.

Mr. FIELDS. Here is the copy of the letter that I have.

Senator ANDERSON. I see there has been a mistake made in reproduction. You are correct.

What I am trying to get to is this, gentlemen: As this matter now lies before us, as the chairman said,

> The proposed arrangement lies before your committee for a 45-day period.

Do I understand that there can be any changes, alterations, amendments, revisions, if the time has started to run, or do you call it the time starting to toll, whatever you lawyers use?

Pennsylvania says:

> We would be perfectly willing to say that the Commission would have a right to buy this research if we tried to pay them off at the end of the first 3, 4, or 7 million dollars.

But nothing like that is in the contract. If they send in a revision to the contract, does that start the 45 days running over again?

Mr. DIAMOND. We would have to resubmit the arrangement to the Joint Committee and it would have to lie before the Joint Committee for 45 days.

Senator ANDERSON. And if you don't do it that way, this becomes effective?

Mr. DIAMOND. If we did resubmit it, I think there would be a question as to the legality of the amendment.

Senator ANDERSON. There is no question about that. I am not a lawyer. I can speak much more freely on those points.

Mr. RAMEY. Getting back to this question of the conditional research and development and the question of the legal obligation to go ahead, the question that remains is that assuming there is no legal compulsion to go ahead with the project after or during the research and development phase, whether or not that is in accordance with the program justification data in the third-round proposal. The committee isn't saying that it is not in conformance, but I think that is something that could be explained a little better, and possibly a legal opinion on it, and have the general accounting office look at it.

Mr. DIAMOND. Did you ask for an opinion on this Mr. Ramey?

Mr. RAMEY. Yes.

Mr. DIAMOND. We will be glad to furnish one for the record.

(The material referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., April 11, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: This letter will acknowledge the Joint Committee's letters of March 28 and March 31 regarding our proposed cooperative arrangement with Pennsylvania Power & Light Co.—Westinghouse Electric Corp. under the third round of the power demonstration program.

I am enclosing copies of a memorandum, dated April 3, 1958, of the Commission's Associate General Counsel expressing his opinion as to the questions raised in the hearing conducted by the Subcommittee on Legislation on March 22, 1958, concerning the basis for the proposed arrangement.

Mr. Diamond concludes that the proposed arrangement is in accordance with the program justification data for the third round, as required by section 111 (b) of the Authorization Act. Your letter of March 28 states that it is your view that there are substantial doubts as to the consistency of the proposed arrangement with the program justification data presented during the past authorization hearings. In the interest of avoiding needless controversy and eliminating any possible doubt as to the authorization for the proposed arrangement, it seems desirable to consider some alternative course of action that will not be subject to the legal and policy questions raised with respect to the basis for arrangement now before the Subcommittee.

We are working actively on this problem, and we expect to be in a position to resubmit the proposed cooperative arrangement to you, on a revised basis, at an early date.

Very truly yours,

LEWIS L. STRAUSS, *Chairman.*

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., April 3, 1958.

Memorandum.
To: K. E. FIELDS, *General Manager.*
From: Edward Diamond, Associate General Counsel.
Subject: Proposed Arrangement with Pennsylvania Power & Light Co.-Westinghouse

In the course of the hearing conducted by the Subcommittee on Legislation of the Joint Committee on Atomic Energy on March 22, 1958, concerning the proposed arrangement between AEC and Pennsylvania Power & Light Co.-Westinghouse Electric Corp. under the third round of the power demonstration reactor program, we were requested to furnish JCAE with legal opinions as to:

(1) Whether the proposed arrangement is in accordance with the program justification data for the third round, as required by section 111 (b) of the act of August 21, 1957, authorizing appropriations for AEC (Public Law 85-162), hereinafter referred to as the "authorization act."

(2) Whether section 111 (b) of the authorization act would require that the proposed supplemental agreement covering phase II of the arrangement be subsequently submitted to the Joint Committee for the statutory 45-day period.

(3) Whether, under the proposed arrangement, AEC can lawfully agree to reimburse Pennsylvania Power & Light-Westinghouse for costs of research and development work performed since January 1, 1958, and prior to the date upon which the requirements of section 111 (b) of the authorization act, for submission to the Joint Committee, have been fully satisfied.

This will advise you that it is my opinion that:

I. The proposed arrangement is in accordance with the program justification data for the third round, as required by section 111 (b) of the authorization act.

Section 111 (b) of the authorization act provides as follows:

"(b) Before the Commission enters into any arrangement (including contract, agreement, and loan) or amendment thereto, the basis of which has not been included in the program justification data previously submitted to the Joint Committee on Atomic Energy in support of authorization legislation approved in accordance with the provisions of section 261 a. (2) of the Atomic Energy Act 1954, as amended, and which involves appropriations authorized by subsection (a) of this section, the basis for the arrangement or amendment thereto which the Commission proposes to execute (including the name of the proposed contractor or party with whom the arrangement is to be made, a general description of the proposed reactor, the estimated amount of the assistance to be provided under section 261 a. (2), the estimated cost to be incurred by the contractor or other party, and the general features of the proposed arrangement or amendment) shall be submitted to the Joint Committee, and a period of forty-five days shall elapse while Congress is in session (in computing such forty-five days there shall be excluded the days on which either House is not in session because of adjournment for more than 3 days): *Provided, however,* That the Joint Committee after having received the basis for a proposed arrangement, or amendment thereto, may by resolution in writing waive the conditions of or all or any portion of such forty-five period: *Provided further, That such arrangement or amendment shall be entered into in accordance with the program justification data described above and the basis for the arrangement or amendment submitted as provided herein:* And provided further, That no basis for a particular arrangement or amendment thereto need be resubmitted to the Joint Committee for the sole reason that the estimated amount of assistance provided for therein exceeds the estimated amount of assistance previously submitted to the Joint Committee by not more than 15 per centum." [Emphasis added.]

The question presented involves the application of the second proviso, underscored above. The "program justification data described above" obviously refers to the "program justification data previously submitted to the Joint Committee on Atomic Energy in support of authorization legislation approved in accordance with the provisions of section 261 a. (2) of the Atomic Energy Act of 1954, as amended."

The intended meaning of the phrase "program justification data" was further clarified in the Joint Committee report on the Authorization Act, as follows:

"The phrase 'program justification data' was intended to include the scope policies, and criteria of the various 'rounds' of the Commission's power demonstration program, as explained by the Commission and interpreted by the com-

mittee at the time of the hearings and outlined in committee reports. It also includes the financial and other data submitted as to the cooperative program generally, and as to particular projects, as set forth by the Commission and interpreted by the committee during the hearings and outlined in committee reports.

"The effect of the requirement with respect to conformance of arrangements with program justification data, as above described, would be to prevvent the Commission from changing its rules and criteria after congressional review during the authorization process. The scope, rules,and criteria of the various rounds of the program could be changed only in connection with resubmission in a subsequent authorization hearing by the Joint Committee."

The determination of the question of conformance of the proposed arrangement with the "program justification data" requires that we examine the scope, policies, and criteria of the program, as explained by the Commission and interpreted by the Joint Committee at the time of the hearings and outlined in the committee report.

The question concerning adherence to the third round criteria arises from the fact that, under the proposed arrangement, Pennsylvania Power & Light-Westinghouse are initially under no legal obligation to construct and operate the proposed nuclear powerplant. Under phase I of the proposed arrangement, they would complete, at AEC's expense (not to exceed $7 million), a program of research and development on which the companies have already expended over $5,500,000 of their own funds. If, upon completion of phase I, it is determined that the proposed plant is technically feasible and AEC is prepared to proceed with phase II, Pennsylvania Power & Light-Westinghouse would be obligated either to enter into a supplemental agreement covering construction and operation of the plant upon the terms stated in the proposal or to repay to AEC the funds expended under phase I. Thus, while Pennsylvania Power & Light-Westinghouse have no legal obligation to proceed with construction of the plant,, a decision to abandon the project will involve the repayment of $7 million to AEC and the abandonment of a total investment in the project of the companies of over $12,500,000.

AEC's announced purpose in issuing the third round invitation was "to provide a continuing program of assistance by the Commission to American industry, both private and public, in using its resources for the development of engineering information on the performance of nuclear power reactors and to advance the time when nuclear power will become economically competitive." Proposals were invited for the development, design, construction, and operation of nuclear powerplants. The invitation itself made it clear, however, that the commitments made by a proposer for construction and operation were not expected to be absolute, but could be subject to conditions to be specified by the proposer. Paragraph 9 (c) of the fact sheet accompanying the invitation stated:

"(c) Proposers will be expected to obtain necessary licenses and approvals of various regulatory agencies. The proposals should summarize conditions applicable to the projects, and should provide evidence to the extent possible that these conditions can be met."

The program justification data for the third round submitted by the Commission referred to 2 third-round proposals which had been received (authorization hearings, pp. 146, 153). In describing their proposals to the Joint Committee, these two proponents made it clear that there was no unconditional legal obligation to construct the proposed reactors. The Florida group's testimony was:

"We cannot, of course, obligate ourselves to continue the project if the research and development work, as it progresses, indicates that the reactor is technically infeasible, or that the plant could not have the characteristics that have been set for it, or it is found, when construction is to begin, that the capital cost is completely out of reason.

"We make the condition, therefore, that, if in the opinion of qualified engineers, the plant is technically feasible and that if the cost estimate for the power made at the time that construction is initiated is not more than 11.5 mills per kilowatt-hour, we will proceed" (authorization hearings, p. 491).

The Florida group further indicated that their offer to construct and operate the reactor was subject to the further condition that satisfactory liability insurance or indemnity provisions would be available (authorization hearings, p. 499).

The other proposer under the third round, Northern States Power Co., testified as follows.

"NSP and Allis-Chalmers are proceeding, under our contract, with engineering designs and research work. It is planned to proceed with construction of the project subject only to:

"(*a*) Obtaining the necessary adequate insurance and indemnification against nuclear energy hazards.

"(*b*) The receipt by NSP and member companies in CUAPA of rulings from State and Federal regulatory bodies and taxing authorities permitting the deduction of their payments for research and development as operating expenses.

"(*c*) AEC entering into a contract with NSP consistent with the provisions of our proposal.

"(*d*) Final authorization by the NSP board of directors. Adherence to our schedule for completion of the project prior to June 30, 1962, depends upon our being able to obtain all the necessary clearances as expeditiously as possible." (Authorization hearings, p. 506.)

In the course of debate in the House and Senate on the Authorization Act and the fiscal year 1958 appropriation act, it was made clear that both the Florida and Northern States proposals were expected to receive consideration under the third round. No question was raised as to their conformity with the third round invitation.

The program justification data for the Northern States arrangement (arrangement No. 58–111–2), submitted to the Joint Committee pursuant to section 111 (b) of the Authorization Act, noted that Northern States Power Co. could terminate the contract if it could not obtain necessary licenses, regulatory agency approvals, or satisfactory liability insurance coverage. The Joint Committee's approval of this arrangement was indicated by its action waiving the 45-day waiting period otherwise required by section 111 (b) of the Authorization Act.

Interpretations made and understandings reached under the first and second round invitations are also considered valid precedents in determining the intent and meaning of the third round invitation. The three invitations were similar in their objectives with respect to reactor construction and operation. The first round announcement invited proposals by applicants "who are willing to assume the risk of construction, ownership, and operation of reactors designed to demonstrate the practical value of such facilities for industrial or commercial purposes." The second round invited proposals "for the development, design, construction, and operation—of power reactors in a wide range of capacities, to demonstrate the practical value of such units for commercial use." Yet proposals which fell far short of assuring construction of a reactor have been considered qualified for AEC assistance under the first and second rounds.

The program justification data on the first round arrangement (arrangement No. 58–111–1) with Consumers Public Power District of Nebraska, submitted to the Joint Committee under section 111 (b) of the Authorization Act, noted that Consumers can terminate if it is unable to obtain satisfactory financing within 12 months from the date of execution of the contract. The Joint Committee indicated its approval of that arrangement by waiving the 45-day waiting period prescribed by section 111 (b).

Under the second round, House Report No. 978 on the Authorization Act noted that AEC had previously entered into a contract with Nuclear Development Associates for the first phase (preliminary design and development) of the arrangement with Chugach Electric Association. Under the Chugach proposal, phase II would consist of detailed design and construction. The report states that "if the initial work indicates that the reactor concept is feasible," definitive development work would be undertaken by NDA under the second phase. The third phase would involve the operation of the reactor by Chugach. No question was raised in the course of the hearings or in the report as to the adherence of the Chugach-NDA arrangement with the criteria for the power demonstration reactor program, despite the fact that the only contractual arrangement in effect is one for research and development work by NDA, and there is as yet no legally binding commitment on the part of Chugach or NDA for the construction and operation of the reactor contemplated by the Chugach proposal.

Further, the report on the Authorization Act, which specifically authorized the appropriation of an amount allocated to the Chugach proposal, recognizes that the proposal involves a 3-phase project; that the authorized funds would first be utilized for the completion of the research and development work under phase I; and that construction would be contingent upon satisfactory completion of the research and development work. The close resemblance between Chugach and Pennsylvania Power & Light-Westinghouse is inescapable. In

the case of Chugach, there is no legally binding commitment on the part of NDA to construct, or on the part of Chugach to operate, the proposed reactor—yet the joint Committee in the authorization hearings and in its report on the Authorization Act raises no question as to the adherence of the Chugach arrangement to the criteria of the power demonstration reactor program. If Chugach is considered responsive to the second round invitation, there would seem to be no sound basis for questioning the parallel situation of Pennsylvania Power & Light-Westinghouse.

These examples, in my opinion, afford a very convincing demonstration that the invitations issued by the Commission for the power demonstration reactor program, as presented in the authorization hearings and as interpreted by the Joint Committee in the report on the Authorization Act, have not been regarded as requiring any guaranty or unconditional assurance that a nuclear powerplant will be built and operated by the proponent under the third round. It is quite clear, from the nature of proposals authorized by the Joint Committee under all three rounds, that the proponent's commitment to construct may be contingent upon the happening of certain events, the acquisition of certain knowledge or the satisfaction of certain material requirements that will make the task of construction a reasonably practicable one. The commitment may, for example, be conditioned upon evidence of technical feasibility, reasonable economic competitiveness, the obtaining of regulatory approvals and satisfactory arrangements for the financing or insuring of the project.

I believe it only fair to conclude, from this examination of the "program justification data" submitted to the Joint Committee, that it is not necessary that a third round proposal include an unconditional commitment for the construction and operation of a reactor and that any third round proposal that gives reasonable assurance of the probability that a nuclear powerplant will be constructed and operated satisfies the statutory requirement that it be in accordance with the program justification data, insofar as such data concern assurance of construction and operation. I believe, further, that it is reasonable to conclude that, under the Pennsylvania Power & Light-Westinghouse proposal, the fact that the proponents would be required to repay $7 million to AEC if they are unwilling to construct the reactor upon determination of its technical feasibility and that this expense would be added to their previous investment of $5,500,000 in research and development on the technology of this reactor would be a very powerful incentive for the proponents to proceed with construction of the reactor. It is my opinion, therefore, that the Pennspyvania Power & Light-Westinghouse arrangement would be in accordance with the program justification data, as required by section 111 (b) of the Authorization Act.

II. Section 111 (b) of the Authorization Act would not require that the Commission resubmit the proposed arrangement for phase II of the agreement prior to entering into the proposed supplemental agreement covering phase II.

Section 111 (b) of the Authorization Act (supra) applies only to arrangements or amendments thereto which involve appropriations authorized by subsection 111 (a) of the Authorization Act. Subsection 111 (a) authorized the appropriation of $129,915,000 for use in the Commission's cooperative power reactor demonstration program. Since the question raised by the Joint Committee would otherwise lack significance, my opinion assumes that the proposed supplemental agreement for phase II would involve use of appropriated funds now or hereafter authorized under subsection 111 (a) of the Authorization Act.

Subsection 111 (b) requires that the Commission submit to the Joint Committee "the basis for the arrangement or amendment thereto which the Commission proposes to execute (including the name of the proposed contractor or party with whom the arrangement is to be made, a general description of the proposed reactor, the estimated amount of the assistance to be provided under section 261 a.(2), the estimated cost to be incurred by the contractor or other party, and the general features of the proposed arrangement or amendment)."

On February 24, 1958, the Commission submitted to the Joint Committee Program Justification Data Arrangement No. 58–111–6 setting forth the basis for the proposed arrangement with Pennsylvania Power & Light-Westinghouse. This statement treated the arrangement as a single project "directed to the construction and operation of a large-scale homogeneous powerplant of the single-region slurry homogeneous type, designed to produce 70,000 to 150,000 net electric kilowatts of energy and to be operated for 5 years as part of the Pennsylvania Power & Light Co.'s system." It is noteworthy that, of the 5 pages of infor-

mation contained in the program justification data, all but a few sentences concern phase II of the proposed arrangements.

The program justification data submitted includes all the types of information as to phase II specifically required by section 111 (b): the names of the proposed contractors (par. A 1); a general description of the proposed reactor (pars. B 1 and B 3); the estimated amount of assistance to be provided (par. D 4); the estimated costs to be incurred by the contractors (par. C); and the general features of the proposed arrangement or amendment (par. D). There is included additional information as to the proposed arrangements for the phase II supplemental agreement in at least as great detail as the information included in the bases for arrangement submitted to the Joint Committee in connection with the proposed contracts with Northern States Power Co. and Consumers Public Power District of Nebraska, in which instances the Joint Committee indicated by its waiver action that these bases for arrangement were considered to comply with the requirements of subsection 111 (b). I must conclude, therefore, that the submission of the program justification data in this instance constitutes the submission of a "basis for arrangement or amendment" sufficient to satisfy the requirements of section 111 (b) as to the proposed supplemental agreement for phase II of the Pennsylvania Power & Light-Westinghouse arrangement.

I find nothing in section 111 (b) that would expressly require the resubmission to the Joint Committee of the basis for an arrangement or amndment thereto before entering into an arrangement or amendment upon the same terms and conditions described in a basis for arrangement or amendment that has been previously submitted to the Joint Committee in the form prescribed by section 111 (b) and has lain before the Joint Committee for the period prescribed by section 111 (b).

A requirement for resubmission should not be implied. In its report on the authorization Act, the Joint Committee stated: "It is the intention of the Joint Committee not to hinder unnecessarily progress under proposals which may be reached by the Commission as a basis for negotiation and submission to the Joint Committee." A requirement for resubmission in the circumstances here present could hinder substantially the progress of the program, since the problem of resubmission, with the doubts and uncertainties it would create as to continuation of the project, would occur at a time when the contract work was in full progress.

The Joint Committee was fully aware that there might be circumstances where resubmission of the basis for an arrangement should be required. Obviously, one occasion where resubmission might be in order would be in a case where the contract that was finally negotiated departed from the terms and conditions stated in the basis for arrangement previously submitted. To take care of this situation, the second proviso of section 111 (b) was enacted, requiring that the arrangement or amendment must be entered into in accordance with the basis for arrangement or amendment previously submitted. The corollary of this requirement is, of course, that resubmission is required if the Commission proposes to enter into an arrangement that is not in accordance with the basis previously submitted. This is clear from the language of the third proviso of subsection 111 (b) that "no basis for a particular arrangement or amendment thereto need be resubmitted to the Joint Committee for the sole reason that the estimated amount of assistance provided for therein exceeds the estimated amount of assistance previously submitted to the Joint Committee by not more than 15 percent." The fact that the Congress did require resubmission of the basis for arrangement where the proposed arrangement would not be in accordance with the basis previously submitted is convincing evidence that there is no implied requirement to resubmit an amendment that is in complete accord with a basis for amendment previously submitted to the Joint Committee, despite a lapse of time in this instance of about 2 years between the date of submission of the basis for the amendment and the date when the supplemental agreement is expected to be excuted. If Congress had intended to require that the basis for an arrangement be resubmitted if the agreement therefor were not executed within a specified period of time, Congress could have so specified, as was done in the case of agreements that are not in accordance with the basis for arrangement previously submitted. The failure of Congress to impose such a time limit must be presumed to indicate that an agreement may be entered into on the terms stated in the basis for arrangement or amendment at any time during the period when the funds appropriated under section 111 (a) remain available for obligation by the Commission.

It is my opinion, therefore, that, upon the expiration of the period prescribed by section 111 (b) during which the basis for arrangement or amendment must lie before the Joint Committee, the Commission is authorized at any time thereafter to enter into the proposed supplemental agreement covering phase II of the arrangement with Pennsylvania Power & Light-Westinghouse on the same terms and conditions stated in the basis for the arrangement or amendment submitted to the Joint Committee on February 24, 1958, and using therefor the funds authorized to be appropriated by section 111 (a) of the Authorization Act.

This opinion is not intended to indicate that resubmission of a basis for arrangement would not be required if AEC desired to enter into a cooperative arrangement on terms and conditions, or providing assistance, that differed from those described in the basis for arrangement previously submitted to the Joint Committee. Moreover, if new authorization is required, under section 261 a. (2) of the Atomic Energy Act, for additional appropriations needed for phase II of the proposed arrangement, the act authorizing such additional appropriations could, of course, require that the Commission submit to the Joint Committee the basis for the proposed amendment prior to entering into the supplemental agreement covering phase II of the arrangement with Pennsylvania Power & Light-Westinghouse.

III. AEC can lawfully agree to reimburse Pennsylvania Power & Light-Westinghouse for costs of research and development work performed since January 1, 1958, and prior to the date when the requirements of section 111 (b) of the Authorization Act for submission to the Joint Committee have been fully satisfied.

Since, as discussed below, retroactive contracts are not ordinarily improper, the difficulty presumably stems from some implied bar to retroactivity, resulting from section 111 (b) of the Authorization Act. Every relevant consideration, however, would indicate that the questioned provision is lawful. Section 111 (b), in terms, presents no bar. It is there provided, in substance, that before the Commission enters into any arrangement of the type under consideration, the basis for the arrangement first must be submitted to the Joint Committee and, unless waived by that body, await the expiration of a prescribed 45-day period. Nothing in that statutory provision suggests that the arrangements thus submitted for the committee's review may not, when effective, provide compensation for work performed during a period of time which precedes the contract's execution—particularly if that period postdates the authorization legislation itself. Under section 111 (b) the Joint Committee is given an opportunity during the specified waiting period to review the proposed arrangement. The element of retroactive compensation is but one element of the proposed arrangement submitted for review and is equally subject to adverse action by the Joint Committee and Congress if disapproved. The function of section 111 (b), in short, is to afford opportunity for Joint Committee surveillance; it bears no indication of an intent flatly to proscribe all retroactivity. If we were to seek limits on retroactivity a more appropriate recourse would be to the effective date of the authorization or appropriation acts—beyond that, retroactivity, like other provisions in the contract, is to be examined on its merits.

The foregoing conclusion is fully compatible with established practices in other areas of contracting. In the sphere of Government contracts, the Armed Services Procurement Regulations, for example, contain recognition that expenses incurred by a contractor preliminary to entering into a contract with the Government may become allowable contract costs. (See 32 CFR 15.502 (a); cf. 32 CFR 8.402 (24)). Such recognition is merely an extension to Government contracts of principles long established in the body of private contract law. (Cf. 5 Corbin on Contracts, sec. 1021; Annotation, 17 ALR 2d 1314.) Retroactivity, in short, is a matter for bargaining between the contracting parties, and the general acceptability of this contracting device would seem to require that its preclusion rest on a firmer foundation than that which may be presently derived from any implications of contrary intent in section 111 (b).

Certain decisions of the Comptroller General afford an additional measure of guidance as to retroactivity. For example, it has been held that the authorization contained in section 201 (i) of the Federal Civil Defense Act to make contributions to States on the basis of civil defense programs or projects "approved by the Administrator" includes the authority to make contributions upon the Administrator's approval where the equipment was contracted for and purchased by the State after the date upon which a Federal appropriation became available for such contribution but prior to the Government's commitment to contribute to the cost thereof (31 Dec. Comp. Gen. 308).

In other areas it is not uncommon for a prospective Government contractor whose bid has been preliminarily accepted, but is subject to approval of higher authority, to commence work prior to the existence of a contractual commitment on the part of the Government. Subsequent approval gives rise to a form of acceptable retroactivity, although if the contract is not approved the contractor will be held to have proceeded at his own risk, with no imposition of liability on the Government. (See 15 Dec. Comp. Gen. 104, 13 Dec. Comp. Gen. 409.) Such authorities adequately demonstrate that, in the normal conduct of Government procurement activities, it is not improper to agree, as part of the contract consideration, to reimburse the contractor for costs incurred in anticipation of a contract, even in those circumstances where the making of a binding contractual commitment is required to await the approval of a higher administrative authority.

Pursuant to the foregoing analysis, it is my opinion that under the proposed arrangement AEC can lawfully agree to reimburse Pennsylvania Power & Light-Westinghouse for costs of research and development work performed subsequent to January 1, 1958, and prior to the date upon which the requirements of section 111 (b) for submission to the Joint Committee have been fully satisfied.

Mr. RAMEY. Had that matter been considered?

Mr. DIAMOND. The question has been considered. There has been no formal opinion written on the subject. But we were satisfied that it did come within the third round.

Representative HOLIFIELD. Have you taken that up with the Comptroller General?

Mr. DIAMOND. No, sir; we have not.

Representative HOLIFIELD. The Chair would like to ask the staff to take this matter up with the Comptroller General so we will be sure we are properly proceeding from their standpoint as well as from your standpoint in this case.

Senator ANDERSON. Mr. Diamond, to return to this question that I asked you at noon, the basis, the legal basis, upon which you are going to refund Pennsylvania Power & Light for $1 million for research that they have done when they haven't had a contract, may we look at the authorization act, section 111 (b): Before the Commission enters into any arrangement, including contracts, agreements, loans, or amendments thereto, the basis of which has not been included in the program justification data previously submitted to the Joint Committee on Atomic Energy in support of authorizing legislation approved in section 261 a. (2) of the Atomic Energy Act of 1954, as amended, and which involves appropriations authorized by subsection (8) of this section, the basis for the arrangement or amendment thereto and submission for proposal to execute, including the name of the proposed contractor or party with which arrangements were made, a general description of the proposal, and the estimated amount of assistance to be provided under section 261 a. (2) the estimated cost to be incurred by the contractor or other party and the general features of the proposed arrangements with him shall be submitted to the Joint Committee and a period of 45 days shall lapse while Congress is in session.

In computing each 45 days, there shall be excluded the days in which neither House is in session—

and so forth.

Do you feel that the basis for that $1 million is in this which is before us?

Mr. DIAMOND. Yes, sir.

Senator ANDERSON. Where is it?

Mr. DIAMOND. Perhaps I answered that too soon. I thought it was here. It should be here.

Mr. FIELDS. I made the statement in the opening statement with respect to it, Senator Anderson. It is on page 3 of the justification data.

Senator ANDERSON. Three?

Mr. FIELDS. Yes, sir.

Mr. DIAMOND. Financial assistance, item 4; the AEC assistance will cover the period starting January 1, 1958, and will total a maximum of $7 million.

Senator ANDERSON. This is assistance after the contract is signed.

Mr. DIAMOND. No, sir; there has been no contract signed yet.

Mr. TOLL. I think the Senator's point is this: The law requires that, before entering into the arrangement, it must be submitted up here for 45 days.

Mr. DIAMOND. The basis for the arrangement.

Mr. TOLL. Yes. Then, if you then enter into the arrangement and make it retroactive, are you circumventing the intent of section 111 (b)?

Mr. DIAMOND. I don't think so.

Senator ANDERSON. You don't think so?

Mr. DIAMOND. I don't think so, sir.

Senator ANDERSON. Would you please give me some legal citation on that, to show where it says that you cannot make a contract effective unless it lies before us for 45 days, but, once you have let it lie before us for 45 days, you can make it retroactive 1, 3, or 10 years? You cite me the provision of law that says you can do that, will you?

Mr. DIAMOND. I will be glad to give you an opinion on this, Senator Anderson.

Senator ANDERSON. I want the law; that is what I pay my lawyers for; to tell me what the law is. I don't want their opinions. I want them to tell me what is in the law. You tell me where the law says that, where you are required to submit this contract to us for 45 days, you can then go back and say, "Having let it lie there 45 days, we will go back as far as we want to."

Mr. DIAMOND. I do not know of any other statute that is similar to the form of the one we have before us.

Representative HOSMER. Will the gentleman yield?

Senator ANDERSON. Yes.

Represnetative HOSMER. Do you know of any prior contracts that have been submitted to the committee that have retroactivity?

Mr. DIAMOND. I believe the Northern States contract has some feature of retroactivity in it.

Representative HOSMER. It seems to me that, in a matter of this type, you have to establish some date where you have conditions outside the contract. I was wondering if that had not been met before in some of these contracts that had been submitted.

Mr. RAMEY. They certainly could not go back of the original authorization.

Mr. DIAMOND. Prior to the date of authorization? I think that would present a problem. But we don't have that in the existing case.

Mr. RAMEY. That is correct. I think it is also true that, as a normal contract practice, it is possible to enter into contracts that are retroactive.

Mr. DIAMOND. That is correct, sir.

Mr. RAMEY. It is a question of the specific effect of this law on the retroactivity feature that you have here.

Mr. DIAMOND. I don't see anything in the authorization bill that affects the question of our right to enter into a contract on a retroactive basis, if that is the proposal, and that is the proposal that we submit to the Joint Committee.

Senator ANDERSON. You said you did this in the Northern States contract?

Mr. DIAMOND. I believe, in the Northern States arrangement, there is some feature of retroactivity in the proposal.

Senator ANDERSON. Of course, I wouldn't know. That was submitted in September when we were all away from here. It was the most advantageous basis you could come in on. Then we had a waiver, and some members of the committee, at least, never had a chance to look at that one. So, this is the first time we have had a chance to raise it. In any event, you feel that, where a law says you have to submit it, and let it lay there a certain number of days before it becomes effective, it can then become effective retroactively. Would you feel any hesitation to go back and pick up a year instead of 4 months?

Mr. DIAMOND. I think there would be some question if we went back prior to the date of the authorization act itself.

I think that would present more of a problem. But, if it is within the period of the authorization act itself, I don't think there would be any legal objection.

Senator ANDERSON. This is 1954, do you mean?

Mr. DIAMOND. No; the authorization act.

Senator ANDERSON. To go back to August 21, 1957?

Mr. DIAMOND. That's correct, sir.

Senator ANDERSON. In other words, if you do not go back and pick up this $1 million, Pennsylvania Power & Light would have to pay it?

Mr. DIAMOND. Well, that isn't their proposal. Their proposal is that we do pick it up.

Senator ANDERSON. I realize that is their proposal. I am merely saying that, if you don't go back and do it, they are going to have to take it. They are going to have to pay it, aren't they?

Mr. FIELDS. Yes.

Senator ANDERSON. So, what you are recommending is a million-dollar refund to them for the purpose of signing this contract, under which they will cease to pay any research and development money and the Government will spend $29 million.

Mr. DIAMOND. That is correct.

Senator ANDERSON. This isn't an enticer to get them to sign it. They have a pretty good contract.

Representative HOLIFIELD. May I pursue a thought along this general line? We are all interested in research and development going forward in these various fields which the Commission has thought to be of advantage in the advancement of the art. But we are faced here with not a firm commitment, as we have been in the cases of consumers of Nebraska and other rounds, where there was a definite commitment.

This is more in the nature of a tentative commitment. I wonder what disadvantage there would be—and I direct my question to you,

Mr. Busby, and Mr. Weaver, if you care to respond—what disadvantage would you be at if the AEC decided that the work which you have done along this line is valuable work and that it needs to be furthered, and they would just engage a straight $7 million contract for research and development in this field without any commitments, and then if, at the end of that period, you would come to us with a firm proposal, as we have had in other cases, and ask us at that time to consider it?

Would that put you folks to a disadvantage?

Mr. BUSBY. So far as I am concerned, that would be a very simple, desirable, and straightforward procedure.

Representative HOLIFIELD. Now I will direct my question to the Commission.

Mr. WEAVER. I concur, Mr. Holifield.

Representative HOLIFIELD. You concur?

Mr. WEAVER. Yes, sir.

Representative HOLIFIELD. Now I will direct my question to the Commission. What advantage would you get, in view of the escape clauses in this contract which Westinghouse and Pennsylvania can call in to play, avail themselves of, or what disadvantage would there be to the Commission in entering into a straight research contract?

Mr. DIAMOND. I think we have definite rights here that go beyond the research contract.

Representative HOLIFIELD. That is what I would like to hear.

Mr. DIAMOND. In the event there is a determination of feasibility, if the companies do not go ahead with the construction of the project, they are obligated to return the amount of money that we have expended for research.

Representative HOLIFIELD. Is that all?

Mr. DIAMOND. This is the compulsion, I believe, that Mr. Hosmer referred to. This is not a legal compulsion, but it is a business compulsion.

It is a business consideration that they would have to weigh.

They would also reimburse the Commission for the amount they have expended for research. So there is an advantage to the Government to have an arrangement that goes beyond a pure research contract.

Representative HOLIFIELD. Then your advantage, as you see, to the Government is a refund of that $7 million, but beyond that there is no commitment for them to go forward if they do refund it?

Mr. DIAMOND. If they refund it, there would be no obligation to go forward.

Representative HOLIFIELD. All right. If they do refund it, the Government would lose the sole rights to the research and development techniques which evolved as a result of the spending of the $7 million?

Mr. DIAMOND. Except for the modification that has been proposed here, that we would have the option as to whether or not we wanted to take back the $7 million, and, in which case if we didn't take back the $7 million, we would be able to retain patent rights.

Representative HOLIFIELD. So with that modification, your job at that time would be to evaluate as to whether it was worth the $7 million or not.

Mr. DIAMOND. That is correct, sir.

Representative HOLIFIELD. And, of course, at that time it is their privilege now to do that, is it not?

Mr. DIAMOND. I am sorry.

Representative HOLIFIELD. It is the privilege of the Pennsylvania people, the way the proposal is written now, for them to make that evaluation?

Mr. DIAMOND. The way it is written now they have the right to make the determination, that is correct.

Representative HOLIFIELD. So, actually, if there is anything there that the Government would consider to be of extraordinary value, under the modification they could avail themselves of it and say "We own it because we spent $7 million."

If there is not at that time, they can just consider the $7 million which is expended as other research and development in experimental work.

Mr. DIAMOND. The Commission would have the right either to retain patent rights and not be reimbursed for the amount it expends, or it would have the right to ask for the $7 million to be paid back to it, if the companies did not go ahead with construction after a determination of feasibility.

Representative HOLIFIELD. If you wanted it, you would have a right to ask for it. But if the Pennsylvania people wanted to go ahead, you wouldn't have a right to ask for it, would you?

Mr. DIAMOND. If the companies did not want to go ahead and if there was a determination of feasibility?

Representative HOLIFIELD. Yes, on your part.

Mr. DIAMOND. They would have to return the money, or with the modification that has been proposed here, we would have the right to decide whether or not we wanted the money refunded to us.

Representative HOLIFIELD. So you feel you would have an advantage in being relieved of the decision of the AEC to require you to pay the $7 million in case you decided not to go ahead.

Mr. BUSBY. We haven't really, apparently, thought——

Representative HOLIFIELD. I am trying to weigh this both ways.

Mr. BUSBY. Thought through this patent point that you raised. We tried to make it perfectly clear that any modified arrangement on that point is agreeable to us. The reason that I said in response to your question of what did we think of just a straightforward 2-year research contract, I thought it was fine, was simply this: It seems to me this proposal points up as a broad proposition the desirability of the AEC having authority to enter into just straight research contracts in proper cases.

Representative HOLIFIELD. They do have that authority under the basic act, as I understand it. It is only when they try to hook it up in 1 of these 3 rounds or power demonstration programs that they get into the prohibitions of previous legislation.

Mr. BUSBY. Perhaps I shouldn't have said so much authority. You get into dollars, too, appropriations and authorizations and so on. Obviously, then in this business of developing a new art, it isn't every worthwhile research project that is going to produce a powerplant. It just isn't that simple.

Senator ANDERSON. I am glad Mr. Holifield brought this question up. I had a note asking about this. I said you outlined your cost

estimates running up into this $30 million, and we were told how uncertain the cost figures had become on many projects.

We know what happened at Shippingport, and we know what has happened at Consolidated-Edison and so forth. You have these cost estimates in, and on the basis of that, the Commission, if it wishes to, can go ahead and never bring this back to the Joint Committee or the Congress in any way.

You would agree to that, wouldn't you?

Mr. BUSBY. I am not sure what the requirements or mechanics are there, Senator.

Senator ANDERSON. Wouldn't you be, General Fields, once you have come in here——

Mr. FIELDS. So long as it meets the conditions of the proposal that have been submitted, that is my interpretation, yes, sir.

Senator ANDERSON. Does the proposal tie it down on a dollar basis?

Mr. FIELDS. Yes, sir, with a ceiling.

Senator ANDERSON. It does?

Mr. FIELDS. Yes, sir. If it departed from those, we would have to come in. There is some provision in the law.

Senator ANDERSON. Even if this figure is changed 2 years from now or 3 years, you don't have to come back to the committee at all?

Mr. FIELDS. I think the law provides 15 percent overage.

Senator ANDERSON. Yes. So it is 15 percent over $30 million?

Mr. FIELDS. Insofar as a submittal under that provision with respect to 45 days is concerned.

Senator ANDERSON. Mr. Diamond, if the Joint Committee felt this was a bad deal, it can't do anything about it, can it, except sit here for 45 days and then it becomes effective.

Mr. DIAMOND. It can legislate to keep us from entering into the contract.

Senator ANDERSON. But you can't pass a resolution saying it is not a good contract.

Mr. DIAMOND. I think that is right.

Senator ANDERSON. What is the real purpose of submitting it to the Joint Committee?

Mr. DIAMOND. This is the law that was proposed by the Joint Committee.

Senator ANDERSON. I am not sure it was proposed by the committee or the Commission. I don't know the exact geneology of all of the provisions of the law. I don't think very many people do. But in any event, we don't have any more to say about it at any time, do we?

I am just trying to find out how I can get into the Congress with a resolution that will hold this thing up. There is nothing we can do, is there, except repeal the law, and the Commission would probably give an adverse report on repealing the law, and the President, therefore, might not sign it if we got it through the Congress?

So, really, we are in a pretty tough spot, aren't we, if we don't like it?

Mr. DIAMOND. I think your view would certainly be taken into consideration before it acted.

Senator ANDERSON. I don't know why. It hasn't been taken into consideration on public projects. The Congress passed a law for two plants, and the President wouldn't sign the bill, and said "Notwithstanding that, I will not do a thing about it."

So why should it be taken into consideration now?

Mr. BUSBY. Senator, may I address myself to your statement?

Senator ANDERSON. Well, you are a good lawyer, obviously, or you wouldn't be in that position. Tell me how I can do anything under the law.

Mr. BUSBY. I can't answer that question, Senator, but I would like to say this, that we consider in this proposal that it is highly important not only that the Atomic Energy Commission find an acceptable basis for negotiating a contract, which they have done after many weeks of negotiation, but that this committee find this project on its merits a worthwhile one. It is implicit in this that there is $18 million for phase 2 hanging in the balance.

Senator ANDERSON. That is the only chance we get. When that comes before the Congress, we get a chance.

Mr. BUSBY. We think it is very desirable that hearings like this be held, and we think it is very desirable that it be established one way or another whether or not this committee thinks this is a worthwhile project.

I would like, from our standpoint, to see you gentlemen let us know what your views on this are. If you say in your judgment that this is no good, we would like to know it. If you think it is worthwhile, we would like to know that, too, but from the standpoint of getting this job done, we think it ought to be fish or cut bait on this thing. We don't think problems of legal technicality or General Accounting Office or whatever should control whether or not this committee thinks this is a worthwhile project.

If this committee thinks it is a worthwhile project as the Commission has in effect already decided, then we think we ought to do all those things that make it possible to go ahead. If on the merits you think it is not a good project, the sooner we stop it and start spending our money on things that are worthwhile the better off we will all be.

This, I think, really is our feeling about how much control your committee has over this situation. We think it is a very full measure of control as a practical matter.

Senator ANDERSON. You are not in too much doubt about me, are you?

Mr. BUSBY. No, sir.

Representative HOLIFIELD. I would like to say that the questions that we ask I hope do not indicate that at all times we are against everything that is proposed here. But we are trying to explore the different possibilities that are inherent in the situation. There have been times when we have been instrumental, I think, in helping industry, as well as maybe standing in their way in some instances.

Mr. BUSBY. I certainly didn't mean to imply that.

Representative HOLIFIELD. No. Your attitude before the committee has been, as far as I am concerned, very acceptable, Mr. Busby. I want you to also feel that the committee is not inimical to the Pennsylvania Power & Light. But we are trying to explore these possibilities, and this is a somewhat different arrangement in that it sets forward a date for a tentative proposal.

Actually, the basic proposal is going to be entered into 2 years from now. As we see the different kinds of escape clauses which are in there, and they may be absolutely necessary, it occurs to us that in addition to

you people and the AEC wanting to take a look at it 2 years from now, maybe the committee would like to take a look at it and exercise judgment on the basis of development in that 2 years. This was why I was asking you the question as to a straight research and development contract without the so-called commitments, which in reality are not commitments.

Mr. BUSBY. I think it would be entirely appropriate for that second look, of course.

Representative HOLIFIELD. This would give all three parties, the Congress, the AEC, and the Pennsylvania Power & Light people, a chance to look at it in the 2 years' time, and at that time to go forward.

But, frankly, I believe that for us to tie our hands and leave the AEC's hands free and your hands free at the end of 2 years is a little bit disadvantageous to the Congress.

Mr. BUSBY. I have no problems at all, Mr. Holifield, with the idea that an additional sum of money such as is being talked about here, for phase 2, merits further consideration.

Representative HOLIFIELD. This will be an amount of $23 million and if we forgo our right to look at it 2 years from now on a tentative basis, you can readily see that at the end of 2 years we may feel badly about action that we would take today.

And even though the $18 million might come up for our authorization, if we felt morally committeed by a binding contract which the AEC has made, we might have to go ahead against our own best judgment and authorize something.

We have done that in the past, I think.

Senator ANDERSON. Could I say there that that is precisely the point. Mr. Holifield helped me express what my feeling is in this matter. Perhaps I ought to read from page 236 of these 1956 hearings in which I said: I think the record ought to show for Mr. Oakes' sake that we are not trying to pick on him here this morning, much as it may sound that way.

We recognize that your company progressively tried to participate in the Shippingport demonstration but was outbid by some other group. But your whole attitude in it was a fine attitude that deserves commendation, and so forth.

You probably recall what I said. I am not hostile to the Pennsylvania Power & Light in this, but I think that every member of the Joint Committee is, to some degree, a joint trustee, or other, of public money. I feel that if we are going to commit ourselves to $30 million at a time when costs rapidly accelerate and when the project may prove to be undesirable or slightly that way, that we ought to have the same chance that you are going to have 2 years from now to take another look at it.

Mr. BUSBY. I don't disagree with that at all, Senator.

Senator ANDERSON. The contract does. The way it come up here it does. The contract says "Once this lays before you 45 days, and you can't do a thing about it, we then will wait 2 years and we will take a look at it and we will transact our business with the Atomic Energy Commission, and we are not in the sightest bit interested, either the Atomic Energy Commission or the Pennsylvania Power & Light, in what the Congress may feel about it."

Mr. BUSBY. Senator, I felt that since $18 million of additional money was involved, this committee would have a hand in indicating

its views as to the desirability or nondesirability of that further $18 million being spent, and that that would be the control point. What I am saying is that I agree that is a perfectly reasonable control point.

Senator ANDERSON. Do you think it would be right for the Appropriations Committees of the Congress to offer Pennsylvania Electric the right to put in $7½ million of research, or the Commission, and then stand up 2 years from now and say, "We will not give you any more money"?

We feel that you have presented the matter properly. It is here with a proposal of financial assistance, the program justification data. It comes in here with the $18 million in it. I think you would have a perfect right to say, "You folks saw that $18 million, you looked at it at the time. You didn't say a word about it then. What right do you have to come into court now? If you wanted to come into court and object to it, you should have done that way back there."

That is why I am doing this now. I feel that the Congress ought to have a little something to say or at least a chance to look at it now.

Mr. BUSBY. We tried to meet that point, which is a very substantial one, by having a provision in the contract which says that if we come to the end of 1959, and technical feasibility has been found, and we are ready to go ahead, and we formally tell the Atomic Energy Commission we are ready to go ahead, within the terms of this proposal, which, among other things, calls for the AEC making available this additional $18 million, knowing that we can't control today whether that $18 million would be available we put in the contract the provision that under those circumstances we said we were ready to go ahead, technical feasibility had been found, but the $18 million was not forthcoming, then, of course, the program would terminate, and the effect would be that we would not be obliged to refund, under those circumstances, the $7 million to the AEC.

That is the way we dealt with it in the contract.

Senator ANDERSON. I don't think you should be under those circumstances. I just wish there might be some way where a little review could be given to the Joint Committee, and, through it, to the Congress, when that first 2-year period expires.

Mr. FIELDS. Senator, I would hope that if that is the wish of the committee, I don't know why we couldn't work it out in some fashion so that there would be a look. There is an advantage, I think, that has not been touched on, though, in looking at this as a project that would carry through to completion, hopefully, and where an authorization in advance would help.

Admittedly, looking at this some time before phase 2 is invoked, if it is a desire of the committee, to review it again at that stage, then that is a consideration.

But I believe authorization at this time, all the way through contingent on technical feasibility, of course, and then on everyone being on board on going ahead, would be an advantage to program this as something that goes through to a reactor that is going to be built. They take certain obligations. I don't look on this $7 million exactly as completely in the context as a refund to the Government. It is also a compulsion on them so that they don't frivolously decide not to go forward with this.

I am sure they wouldn't. But if you get these things started, and you get this group at Westinghouse, you get Pennsylvania Power & Light acquiring sites, you get many things going on probably during this phase 1 or near the end of it, that I think will gather momentum here. The reason we put the whole authorization forward at this time is I think the law requires that cooperative programs be put forward. When we go out with industrial contractors, I think it helps when you have an end objective more than just research and development, Mr. Chairman, which, maybe, would be what the first phase of this would be. So if the question is to come back and look at this again on phase 2, we could surely work out something to do that. I think there is still an advantage to getting the overall authorization, though, at this time.

Representative HOSMER. There is another side of the coin, which Senator Anderson mentioned. When you come back, the situation is a little bit changed, and the Commission is breathing hot and heavy to have them go ahead, but these people are a little more reluctant than they are now, and will want some of these figures boosted up a little bit.

We don't want this review used 2 years hence as a lever. The way you have it set up now, you have a straight deal, with a price and maximums and so forth.

Mr. FIELDS. That is right.

Representative HOSMER. Will you protect yourself on that if you make this change as suggested? I bring it up because it is a very practical consideration. What you are essentially buying is a continuous program, and inserting a compulsion for them to go ahead with it.

But in this 2-year-from-now review, we wouldn't want to either reduce that nor provide an opportunity to work a more advantageous deal for them as against the Government than set forth here.

Mr. FIELDS. I had more in mind something of a report to this committee at some stage before you invoke phase 2, rather than changing the considerations and conditions of the proposal, or the aspects of it.

Senator ANDERSON. I will agree with that definitely. I think the point Mr. Hosmer makes is a good point. You have to protect yourself the best you know how. I am only trying to point out that the joint committee is set up a little differently than most of the congressional committees, and it has to stand as telling the rest of the Congress that everything is all right. We have a responsibility to take a hard look at this financial deal. It may be a fine financial deal. It may be all right. I happen to be one of those who is extremely enthusiastic about this type of approach.

Representative HOLIFIELD. I happen to be the same way. I think from a technical standpoint, this is something that ought to be done.

Senator ANDERSON. So do I. On top of that, I have had some people telling me that they think a very substantial breakthrough in this field is about to be either announced or soon to be announced that may give a lot of encouragement to this whole program.

If so, it is a very fine way to proceed. I would like to see you go ahead. I have no objection to Pennsylvania Power & Light doing it. I have no objection to the private utilities coming in and doing it. I have said over and over again that as far as I am concerned, this hasn't been a public versus private power fight.

I had written to Willis Gale after he made his speech in which he advocated that they go ahead and develop on the basis of about the proportions that they had in the generation of power, and he said it would be a pretty good idea, that there would be 6 plants built by private industry to every 1 that was built by public groups.

That doesn't worry me a particle. I want to see it go ahead. But I want to see every possible bit of protection.

Mr. FIELDS. I think it could go forward with the authorization such as we are talking about, with a review of some kind before phase 2 is invoked. I think there are some definite advantages on the Government side to this. I would wager from the little knowledge I have of some of this business, that if they have this proposal as opposed to a straight research and development contract, they would get more out of their research dollars than they would just as a straight research contract.

This is the way things work. When you have an objective at the end, you are going to do your best to get there. If we had the authorization that we have requested, and we meet the conditions that are proposed in here—that this would only go forward if it proves feasible, with the conditions as they are proposed in here, proving out—then this thing will go much more rapidly than to have other reprograming or considerations coming in at a later date, a new direction to be taken.

Representative HOSMER. There is just one other question I want to ask you about this 2-year-from-now review. Can it be wrapped up in such terms as it does not have an adverse effect upon the scientific personnel engaged in the program, that is, so that they wouldn't say, "Well, we have just a 1- or 2-year thing here," and then somebody else comes along and says, "Well, we will give you a 5-year contract," and the people are taken away. Can it be done to avoid that type of situation?

Mr. FIELD. I haven't really thought too much about it. I would think it could be; yes, sir.

Representative HOSMER. That is important to my mind, as I indicated this morning. We have this migrant scientific personnel problem that it not doing the country any good.

Mr. FIELDS. I think it would proceed on the basis that so long as this is meeting with successes, meeting the conditions of this proposal, when this report comes in on phase 1, if it looks good, it will go ahead. After all, we all negotiated in good faith, and if we do prove to come up with something that is good, it ought to go forward. I would think we could design something. I don't know that it would be something that would be—well, I am not enough of a lawyer to say whether it can be a requirement of law, Senator.

Senator ANDERSON. Didn't you think at one time, General Fields, they would have to come in at the end of 2 years on phase 2, and Mr. Morris, I believe, felt the same thing?

Then Mr. Diamond said that wasn't the way the law was.

Mr. DIAMOND. I heard Mr. Morris make the statement last week when the Florida proposal was before the committee. I should have perhaps jumped up at that point and corrected Mr. Morris. But since the Pennsylvania Power & Light proposal was not before the committee last week, I thought we could correct it today.

Senator ANDERSON. You corrected it to the great disadvantage of these people, because it scares us now. We might take a position on Florida Power & Light we would not have taken otherwise.

Mr. FIELDS. I had clearly in mind that we would be up in 1959 for the authorization for $18 million.

Mr. RAMEY. Do you need that for 1959?

Mr. FIELDS. In a sense I have been talking about we are going to be negotiating, getting this project set up, and I think it would be well to have the authorization. It isn't absolutely necessary, perhaps. It has been our judgment that it should be in 1959.

Senator ANDERSON. Then we really would be foreclosed, wouldn't we? That would make sure that we wouldn't get a look at it.

Mr. FIELDS. That was not the intent, Senator.

Well, sir, it has been my feeling that programs that are authorized in advance so that you know what the purpose is and the intent, go better during their research and development period than when you have to come in with subsequent authorizations.

Senator ANDERSON. They have to come to you. You don't mind them coming and talking to you, but you just don't want them talking to us.

Mr. FIELDS. I am willing to come and talk to you, sir.

Mr. RAMEY. Would there be any objection, if your legal opinion is correct, that you aren't required to submit this under the 45-day provision, would there be objection to having a provision in the 1959 authorization when these funds are authorized to provide for the resubmission of this at the time you hit phase 2?

Mr. DIAMOND. I think this raises the question that Mr. Hosmer raised a few minutes ago. I think the committee perhaps ought to think about that.

Mr. FIELDS. Could we study this and be prepared on this question when the 1959 authorization is before you? That would probably be a good time in which to deal with this question specifically.

We can look at it in the meantime in the light of this discussion and see what we would recommend at that stage.

Mr. RAMEY. The question was whether if we had, in addition of the authorization of $18 million, at the time it reached the phase-2 project, it be resubmitted for review under the 45-day provision.

Mr. FIELDS. I was suggesting that we be prepared for comments specifically on that, sir, at that time.

Representative HOLIFIELD. I am certainly not antagonistic to the procedure in this field of the homogeneous reactor. I think it is high time, and I thought it several years ago, that we get on with this job. But I think you understand the position that we are in in relation to this particular proposal compared with other proposals that have been before us. They have been firm in nature. This is really tentative in nature. I would like to think this over myself a little bit. I certainly would not want to lightly say "No," or unthoughtfully say "Yes" too quickly on this.

Mr. FIELDS. Part of this comes from the fact that this is a more advanced reactor in generations, or whatever the word is here, than some of the others have been.

Representative HOLIFIELD. You are actually taking a longer gamble on this than you are on some of the other types.

Mr. FIELDS. Yes.

Representative HOLIFIELD. You are really jumping over a fair-sized prototype here into almost a full size—well, it is a full size. You are jumping over the intermediate step, actually. That is, you are tentatively jumping over it.

Mr. FIELDS. It is a good jump.

Mr. WEAVER. Mr. Holifield, if I may, I would like to refer to Mr. Hosmer's remarks. Speaking as one who was responsible for the technical organization which will be doing this job, I think it is tremendously important that all of us, ourselves, Pennsylvania Power & Light, the Commission, and the committee, be completely familiar insofar as possible with the progress that is being made on this work over this 2-year period, and that some method be developed so that we don't come to a day, January 1, 1960, or something like that, when we are going to make a decision affecting a whole project and a lot of people and everything like that.

There must be a way so we could feel our way as we go along and know better how things are progressing, and be able to take steps sufficiently in advance of any deadline so that we can handle ourselves properly with people as well as the technical work.

Representative HOLIFIELD. How about this type of arrangement: Assuming that this committee, and, of course, we would have to consult with the committee members, authorized a $7 million research-and-developmentæ program, with this type of a general program in mind, and we take another look at this on January of next year. You would have some time behind you, you would have the expenditure of at least a year, half your program, probably, at that time, half of your research program I am talking about, your phase 1 research program, and we would take a look at it then. There will be another authorization bill up in 1959, that is, for 1959–60. The one we are talking about now is for 1958–59 or fiscal year 1959, and then we would be talking about 1959–60, the fiscal year 1960.

Do you think that would be of any disadvantage to you? It would at least give us a year's experience to look at this thing.

Mr. WEAVER. I think this is in line with the suggestion I was making. I don't know how formally we do this. I am suggesting that you gentlemen who are interested and responsible should know what is going on. This could be accomplished in several ways. I think you should determine that.

Representative HOLIFIELD. We could, of course, utilize the 202 hearings in January of 1959 for a report, or February of 1959 for a report. I think you folks would be further along. You would be in a better position at that time than you are at this time, because you are projecting your thoughts 2 years.

Mr. WEAVER. I would like to emphasize that we will be, as between Pennsylvania Power & Light and Westinghouse, regularly reviewing our program and our problems.

Representative HOLIFIELD. I realize you will, but we will not. This is the point I am soliciting—the idea of considering letting us in on the review on the basis of an annual type.

Mr. BUSBY. Mr. Chairman, on that point I would like to say just this, that it seems to me there are some advantages in continuing the 1958–59 program as it is set up because that program has been set

up under the leadership here, really, of Dr. Johnson, to produce a certain given result. Of course, we cannot be sure it is going to produce it, but it is designed to produce a given result: Namely, to look at all of these major-problem areas which we have to have reasonable assurance on before you can commit on building plant.

There is a steam factor. You get the ball going, and you keep it going, and you are making progress toward that objective. You have the carrots dangling out there at the end of a stick and at the end of 2 years you hope to reach that point. It seems to me there is advantage in keeping the impetus of motion and objective and target that is all wrapped up in that concept. At the same time we agree fully with you that it is wise to have check points as you go along.

One of the built-in advantages of this arrangement is that it is not in our interest at all to delude the joint committee about the prospects of this project, because we have an economic incentive for our saying as soon as we find it is no good to say so.

We would just be pouring our own money down the drain then, if we knew a year from now it was technically infeasible and we kept on spending money. Then we would know we had a bigger amount to reimburse to AEC.

Representative HOLIFIELD. If we made the $7 million available for the 2 years' research and development, and then a year from today we look at the phase 2 feasibility program and consider its authorization at that time in the same good faith that you folks are going to look at it, and AEC is going to look at it, it would seem to me that this might be a reasonable way to go ahead.

Mr. BUSBY. It seems very sensible to me. Indeed, we tried last year, and this year, and we would certainly have in mind to do the same thing next year, in the 202 hearings, to lay before you gentlemen a full progress report on how the program is coming along.

Representative HOLIFIELD. I think that type of an arrangement would probably be worked out between the AEC and the committee, if the rest of the members of the committee would follow the recommendation of this subcommittee.

Are there any further questions that we should go into on this?

Mr. RAMEY. Could you describe the manner in which U–233 would be processed under your arrangement in a homogeneous reactor?

Dr. JOHNSON. Do you mean chemically reprocessed?

Mr. RAMEY. Yes.

Dr. JOHNSON. We have two methods under consideration. One is to build a reprocessing plant, similar to the Thorex plant now in operation, either as part of the plant or on the same site as the plan.

The second alternative would be to fatswise reprocess. That is to remove a portion of the fuel and send it to some centralized reprocessing plant.

In the $57 million cost estimate we have submitted, this is on the basis of having a plant site reprocessing plant as an overall part.

Mr. RAMEY. Would the development of that involve any AEC research and development assistance?

Dr. JOHNSON. There is money in the program for the development of what we call the head end and the tail end of the process. That is taking the fuel from the plant and preparing it for the Thorex type reprocessing, and equipment for reslurring the fuel at the far end of

the reprocessing plant. The part in the middle has essentially already been developed in the Thorex process.

Mr. RAMEY. Does the contract permit Pennsylvania Power & Light to install a larger turbogenerator set than the estimated reactor output? In other words, the reactor output is estimated from 70 to 150 megawatts. Would you put in a 150-Megawatt generator even though you would estimate the reactor at 100 in order to make the extra power later? Shippingport is 100, although the estimate output was 60 so far as the reactor was concerned.

Mr. BUSBY. Mr. Ramey, we are just not far enough along to answer that. I appreciate, it is the Shippingport situation, for example, where you put in a big enough machine to handle additional heat output. We would consider, of course, the potential of the reactor in terms of the size of machine we put in.

We just don't know enough yet. We don't know, for instance, the relative gains and disadvantages of a 70,000 machine against a 150,000 machine.

That is why we left open the range as to the size of the reactor and the size of the turbine both. I think maybe sometime in the future, though I couldn't tell you exactly when, we are going to make a decision on that, of course. But we have not made it yet.

Representative HOLIFIELD. Enlighten me on this point: In a case like this, would you have two machines, say, of 75,000 capacity, or would it, of necessity, be one large machine?

Mr. BUSBY. Economics would dictate one machine.

Representative HOLIFIELD. One large one. So, in effect, if you did put in a large machine, would you be gambling on an increase in efficiency of the reactor somewhat between the 70 and the 150?

Mr. BUSBY. No, sir.

We are thinking of a variable in the size of the reactor as well as a variable in the size of the turbine.

Representative HOLIFIELD. What were you thinking of as the size of the turbine?

Mr. BUSBY. When we said a turbine output electrical of 70,000 to 150,000, we were really saying that we had in mind a reactor range which would be of a size to produce heat that would go either with a 70,000 as a low point or, as a high point, 150,000 electrical. What we are really saying is we haven't decided whether this would be a 4-loop reactor plant, or a 3-loop reactor plant, or a 2-loop reactor plant.

Representative HOLIFIELD. Do you think you would be in a position a year from now to make that decision?

Mr. BUSBY. We would be a lot closer to it.

Representative HOLIFIELD. Your estimate on cost was 150.

Mr. BUSBY. Right.

Representative HOLIFIELD. Argonne, I think, sort of got caught in a situation, due to a number of factors, that it can produce a lot more power than they have electrical facilities to take it off.

Mr. BUSBY. Either way it is an expensive decision if you don't do it right.

Mr. WEAVER. But I think it is a decision that has to be deferred until you know enough to proceed with the plant.

Representative HOSMER. It is all speculation.

Mr. WEAVER. Yes; exactly.

Mr. DAVIS. And there is more latitude to be wrong in a boiling water plant than any other kind.

Mr. WEAVER. And especially where we know the plant capability but not the fuel.

Representative HOLIFIELD. Is there anything further?

Representative HOSMER. No.

Representative HOLIFIELD. At this time I think I will ask the AEC witnesses to stay in executive session for a few minutes.

We will excuse you gentlemen at this time. Thank you very much for your attendance today, particularly on Saturday.

We do not like to work on a Saturday any more than you do, probably, but we usually find ourselves doing it.

Mr. FIELDS. Mr. Chairman, I want to say on the side of the Commission we appreciate your doing it.

Representative HOLIFIELD. One of the reasons we had to have it today was because the Easter recess is coming up, and we have some other things to tend to next week.

We wanted to get this hearing on the record before the Easter recess, as you know.

Mr. FIELDS. This is a very hard working committee.

Representative HOLIFIELD. I think the Westinghouse people also had problems next week.

Mr. WEAVER. We did, and we greatly appreciate your consideration in establishing this date.

Mr. BUSBY. We thank you.

Mr. Chairman, would it be wise for the record in these hearings to include the testimony and the program report that was filed in the section 202 hearings just a short while ago?

Representative HOLIFIELD. We will accept it for the file. It was put in the 202, wasn't it?

Mr. BUSBY. Yes, we can incorporate it by reference, I should think.

Representative HOLIFIELD. Incorporate them by reference and the committee will decide whether to print it or not in these particular hearings. (See Hearings on Development, Growth, and State of the Atomic Energy Industry, pp. 277–293.)

Thank you gentlemen.

(Subsequent to the hearing, the following correspondence and documents pertaining to this proposed project were received for the record:)

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
March 26, 1958.

Hon. JOSEPH CAMPBELL,
Comptroller General, General Accounting Office,
Washington, D. C.

DEAR MR. CAMBELL: Under section 111 b. of the Public Law 85–156, the AEC Authorization Act for fiscal year 1958, the Atomic Energy Commission, before entering into any arrangement, must submit the basis of the proposed arrangement to the Joint Committee, and a period of 45 days shall elapse while Congress is in session unless waived by the Joint Committee.

On Saturday, March 22, 1958, the Subcommittee on Legislation of the Joint Committee held a hearing concerning the basis of proposed arrangement No. 58–111–6 (copy enclosed). Representatives of the Atomic Energy Commission, the Pennsylvania Power & Light Co., and the Westinghouse Electric Corp. testified during this hearing, and a copy of the transcript of the hearing has been delivered to staff members of the General Accounting Office.

During the hearing certain questions were raised concerning the proposed arrangement, including the following:

In view of a lack of a definite obligation on the part of the proposers to construct and operate the reactor, is the proposed arrangement consistent with the program justification data submitted to the Joint Committee during the hearings on the authorization bill (Public Law 85–156) last spring?

Does the provision of payments retroactive to January 1, 1958, circumvent the intent of section 111 b. of Public Law 85–156?

Funds are requested at this time only for phase I of the proposed contract (1958–59, $7 million). Would the Commission be authorized to proceed with phase II of the contract without resubmitting the proposed arrangement to the Joint Committee and the Congress?

The above questions are indicative of only some of the questions raised during the hearing. It would be appreciated if you would review the transcript of the hearing and furnish an opinion as to the proposed arrangement, including an opinion as to the matters raised by the above questions.

Your cooperation is appreciated.

Sincerely yours,

CHET HOLIFIELD,
Chairman, Subcommittee on Legislation.

COMPTROLLER GENERAL OF THE UNITED STATES,
Washington, April 8, 1958.

Hon. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation,
Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. CHAIRMAN: Reference is made to your letter of March 26, 1958, requesting our opinion on the proposed arrangement between the Atomic Energy Commission and the Pennsylvania Power & Light Co. and Westinghouse Electric Corp. for the furnishing of research assistance by the Commission in connection with the development of a single-region slurry homogeneous-type reactor operating on the thorium-uranium cycle.

The basis of the proposed arrangement was submitted to the Joint Committee on Atomic Energy on February 24, 1958, in accordance with the requirements of section 111 b. of the AEC Authorization Act for the fiscal year 1958 (71 Stat. 409–410), and on March 22, 1958, your subcommittee held a hearing on the Commission's request for a waiver of the 45-day waiting period otherwise required by section 111 b. Your letter mentions several questions which were raised during the hearing concerning the proposed arrangement, including the consistency of the arrangement with the program justification data submitted to the Joint Committee in support of the 1958 AEC Authorization Act.

Section 111 b. of that act provides in part as follows:

"(b) Before the Commission enters into any arrangement * * *, the basis of which has not been included in the program justification data previously submitted to the Joint Committee on Atomic Energy in support of authorization legislation approved in accordance with the provisions of section 261 a. (2) of the Atomic Energy Act of 1954, as amended, and which involves appropriations authorized by subsection (a) of this section, the basis for the arrangement * * * shall be submitted to the Joint Committee, * * *: *Provided, however*, That the Joint Committee after having received the basis for a proposed arrangement, or amendment thereto, may by resolution in writing waive the conditions of or all or any portion of such forty-five-day period: *Provided further*, That such arrangement or amendment shall be entered into in accordance with the program justification data described above and the basis for the arrangement or amendment submitted as provided herein: * * *"

The purpose and intended effect of section 111 (b) is stated at pages 33–36 of the House report on the bill (H. Rept. 978, 85th Cong., 1st sess.). The following language appears at pages 34–35:

"The second proviso in section 111 (b) provides that such arrangements or amendment must be entered into in accordance with 'program justification data' submitted in connection with the hearings, and with the 'basis' of the arrangement as described above. The phrase 'program justification data' was intended to include the scope, policies, and criteria of the various 'rounds' of the Commis-

sion's power demonstration program, as explained by the Commission and interpreted by the committee at the time of the hearings and outlined in committee reports. It also includes the fianncial and other data submitted as to the cooperative program generally, and as to particular projects, as set forth by the Commission and interpreted by the committee during the hearings and outlined in committee reports.

"The effect of the requirement with respect to conformance of arrangements with program justification data, as above described, would be to prevent the Commission from changing its rules and criteria after congressional review during the authorization process. The scope, rules, and criteria of the various rounds of the program could be changed only in connection with resubmission in a subsequent authorization hearing by the Joint Committee."

The proposed P. P. & L.-Westinghouse arrangement is under the third round of the Commission's power demonstration reactor program, and it must, therefore, accord with the program justification data for that round which was submitted to the Joint Committee in support of the Commission's 1958 authorization act. The original announcement of the third round on January 7, 1957, stated that proposals were invited—

"* * * to develop, design, construct, and operate nuclear powerplants."

Other conditions of the third round invitation, particularly those concerning technical feasibility and construction and operation, are as follows:

"The research and development assistance requested in the proposals must be well defined and for fixed dollar amounts."

* * * * * * *

"* * * The technology of two other types of reactors is such that construction of additional large-scale demonstration projects of these types within the specified time schedule is warranted and desirable. These types are:

"*a.* The natural uranium-fueled, heavy-water-moderated reactor;

"*b.* The fluid-fuel reactor system based on aqueous solutions or slurries of uranium or of uranium and thorium-bearing materials.

"Other types of reactors will be specified by the Commission for construction as technological progress appears to warrant such announcements.

"If industry does not submit acceptable proposals for reactor plants of the types considered ready for full-scale construction, the Commission will request additional funds to initiate such projects under complete Federal financing."

* * * * * * *

"Commission assistance will be limited to research and development. Proposers will be required to provide funds for plant construction. * * *"

* * * * * * *

"Proposals also may be made by organizations which have nuclear power projects underway. * * *"

The Fact Sheet attached to the third round invitation contained the following pertinent provisions:

"7. *Types of assistance that may be considered by the Commission.*

* * * * * * *

"c. Entering into research and development contracts with the proposer under section 31 (a) of the Atomic Energy Act of 1954. The Commission will consider requests for such contracts in support of specifically described research and development programs in connection with the design and construction of the reactor. The Commission will also consider requests for research and development assistance in connection with reactor operation in recognition of exigencies related to the experimental nature of the project, such as examining causes of fuel element failure and other experimental operations. * * *

* * * * * * *

"8. *Criteria for acceptance of proposals.*

* * * * * * *

"b. * * * The Commission will take into consideration the technological advancement represented by the proposed design. However, the proposed design should not be so advanced as to require as part of the proposal a program of research and development of indeterminate scope, duration, and nature, or to result in inability to determine with reasonable accuracy any elements of cost where AEC assistance is requested.

"c. Technical and financial competence of the party making a proposal * * * to meet the responsibilities entailed in the proposal, including but not limited to development, design, engineering, construction, ownership, and subsequent operation of the reactor facility proposed.

"9. *Other conditions.*

"a. Proposals must:

* * * * * * *

"(5) Contain a detailed budget covering capital costs and operating costs of the project through the requested period of the contract.

* * * * * * *

"(10) Specify completion of reactor construction by June 30, 1962, or earlier, and contain sufficient backup data to establish the reasonableness of this schedule."

Thereafter, on June 10, 1957, the Commission announced an extension of the date required in the original announcement for completion of construction of reactors of the fluid-fuel type. This announcement contained the following pertinent provisions:

"* * * This modification to the third invitation provides for an extension of the required completion date for full-scale plants utilizing fluid fuel reactor systems from June 30, 1962, to at least June 30, 1963. This extension is necessitated by delays experienced in the Commission's research and development program which is expected to provide basic information necessary to the subsequent construction of full-scale plants of this specific type.

* * * * * * *

"The delays encountered in the aqueous fluid fuel development program do not affect the Commission's belief, as expressed in the third invitation, that construction of a large-scale demonstration project of this type is warranted and desirable, and that the industrial public is therefore urged to consider this concept for inclusion in proposals."

A fair reading of the third round invitation and the extension compels the conclusion that proposals were desired for the construction and operation of plants of the two types specified, as well as for research and development of acceptable designs. The original invitation stated that construction of large-scale demonstration projects of these two types was warranted and desirable technologically, and this belief was reiterated in the extension announcement. Indeed, proposers were specifically warned in the invitation that their proposed design should not be so technologically advanced as to require a program of research and development of indeterminate scope.

In the proposers' letter of January 15, 1958, to the Commission it is stated that they had been conducting research and development on the homogeneous type of reactor since July of 1955, at a cost of some $5.5 million. The letter further states that the objective of their proposal is—

"* * * to obtain the necessary additional information required to resolve the question of feasibility and, if resolved favorably, to proceed with the construction of the plant.

"* * * More knowledge about this advanced reactor type is plainly needed. Our conclusion is that 2 years of further research and development is necessary before a prudent decision can be made as to construction of a large-scale nuclear powerplant of this type."

In line with this language, the proposal requests the AEC to assume the expense of research and design development during a 2-year period from January 1, 1958, to December 31, 1959, not to exceed $7 million. At the end of that time, the AEC and the proposers will make a joint determination as to the technical feasibility of the proposed reactor plant assuming a plant completion date which could be reasonably expected from additional research and development, at a cost to AEC of not to exceed $18,330,000. In other words, no determination will be made as to whether or not it is technically feasible to construct a nuclear plant of the type in question until after 2 years' research. In addition, the proposal also gives the proposers the right, regardless of the technical feasibility determination, to refuse to proceed further with the project upon repayment of financial assistance given by the Commission during the initial 2-year research period. While it is true that some of the other proposals AEC has considered favorably have provided that construction is contingent upon matters such as the proposers' obtaining necessary licenses and approvals of various regulatory agencies, adequate insurance and indemnification against

nuclear energy hazards, and satisfactory financing within 12 months of the date of the contract, it should be noted that such contingencies are not matters completely within the control of the proposers. We believe the unilateral and unqualified right of the proposers in the instant case to abandon the project is a substantially different arrangement.

The basic justification for undertaking the power demonstration reactor program was stated in a letter of August 30, 1956, from the General Manager of the Commission to the Comptroller General as follows:

"The power demonstration reactor program rested on the fact that production of electric energy by nuclear means has not yet been shown to be competitive with conventional generation, and that the economics of nuclear production of energy are not fully known. Further, it was apparent that construction of full-scale plants was, at the appropriate stage in technological development, the best means of obtaining technical and economic information needed to determine the economic potentialities of different reactor types. The power demonstration reactor program was designed to encourage industry to construct such reactors with limited Government assistance, as an alternative to direct Government construction. Since the Commission had a current need for the technical and economic information to be obtained from the construction and operation of the reactor, and since that need could be satisfied at less expense to the Government by offering assistance to privately financed projects than by construction of Government plants, the Commission felt warranted in offering to obligate itself to furnish such assistance in consideration for the proposer's undertaking to construct and operate the reactor and furnish the information from it."

Essentially, it seems to us, the third round invitation, as well as those under the two preceding rounds, contemplated that proposals would be based on an existing belief by proposers in the technological feasibility of projects proposed, whereas the P. P. & L.-Westinghouse proposal clearly admits that it will take 2 more years' research before any determination as to feasibility and subsequent construction can be made.

For the above reasons, we are of the opinion that the P. P. & L.-Westinghouse proposal is not in accordance with the program justification data previously submitted to the Joint Committee in support of the authorization legislation here involved.

Your letter of March 26, 1958, also requests our opinion on the retroactive feature of the proposed arrangement. As stated above, Pennsylvania and Westinghouse began research on this type of reactor in July 1955 and have spent, up to January 1, 1958, approximately $5.5 million in such work. That work is presently continuing, at a cost to Pennsylvania and Westinghouse of approximately $300,000 a month. Their proposal which was made in December 1957 requested that the AEC assume such continuing costs effective from January 1, 1958, for 2 years. The question which arose during the course of the waiver hearings was whether the proposed reimbursement by AEC of costs incurred since January 1, 1958, which is, of course, prior to the submission of the proposal to the Joint Committee and prior to the making of any contract, would be tantamount to a circumvention of the requirements of section 111 (b) of the 1958 authorization act. We find nothing in section 111 (b) or in the Atomic Energy Act of 1954, as amended, which prohibits reimbursement of such retroactive costs. While the third round invitation did not mention the possibility of the reimbursement by AEC of costs incurred prior to the signing of a contract, neither did it preclude such a possibility. Further, the invitation stated that proposals might be made by organizations which had nuclear power projects underway. In the instant case, it will be noted that reimbursement is not sought for any costs incurred prior to the time when financial assistance was requested from the Commission. No contract has been made imposing liability for such costs on the Government, and the proposers are bearing the risk of having to assume the costs themselves in the event a contract is not finally executed. It may also be noted that such provisions are not unusual in other Government contracts. Under the circumstances, it is our opinion that the retroactive reimbursement feature of the proposed arrangement does not affect its validity.

The third question suggested in your letter of March 26, 1958, is whether the AEC would be authorized to proceed with the second phase of the proposed arrangement; that is, the further research and actual plant construction and operation, without resubmitting the basis for the second phase to the Joint Committee.

As we have stated, we are of the opinion that the Pennsylvania Power & Light-Westinghouse proposal is not in accordance with the program justification data previously submitted to the Joint Committee in support of the authorizing legislation here involved. Consequently, the proposal in its entirety does not meet the requirements of the second proviso of section 111 (b) of the AEC authorization act for fiscal 1958, and neither phase of the proposal may be considered as having been effectively submitted to the Joint Committee in the absence of further specific authority of law.

In conclusion, it is our opinion that specific statutory authorization is required to enable a valid contract to be made on the basis of the presently proposed arrangement.

Sincerely yours,

JOSEPH CAMPBELL,
Comptroller General of the United States.

[S. Con. Res. 78, 85th Cong., 2d sess., introduced by Senator Anderson on April 1, 1958]

CONCURRENT RESOLUTION

Whereas by letter dated February 24, 1958, the Atomic Energy Commission submitted to the Joint Committee on Atomic Energy the basis of a proposed arrangement Numbered 58–111–6 between the Atomic Energy Commission and the Pennsylvania Power and Light Company and the Westinghouse Electric Corporation to provide Government assistance in the total amount of $29,341,000 for a tentatively proposed reactor project; and

Whereas section 111 b. of Public Law 85–162 requires that before the Commission enters into any arrangement which involves appropriations authorized by subsection 111 a. thereof the basis for the proposed arrangement shall be submitted to the Joint Committee on Atomic Energy, and a period of forty-five days shall lapse while Congress is in session (in computing such forty-five days, there shall be excluded the days in which either House is not in sesion because of adjournment for more than three days), unless such forty-five day period is waived by the Joint Committee; and

Whereas such forty-five day period will expire on April 21, 1958, unless affirmative action is taken by the Congress of the United States or the Commission withdraws the proposed arrangement; and

Whereas the Subcommitte on Legislation of the Joint Committee reviewed the basis of this proposed arrangement at a public hearing held on March 22, 1958; and

Whereas it appears that the proposed arrangement is not in accordance with the program justification data for the third round of the Atomic Energy Commission power demonstration reactor program, as described during the authorization hearings before the Joint Committee in June 1957, prior to the adoption of Public Law 85–162, particularly because it does not contain a definite obligation to construct and operate the reactor as contemplated by the third round; and

Whereas the proposed arrangement does not provide adequate protection for the public interest with respect to patent rights on work to be financed by the Federal Government; and does not provide for resubmission to the Joint Committee and the Congress of the arrangement in the event a decision is made at a later date to construct and operate the reactor; and contains certain retroactive features which may circumvent the intent of the forty-five-day review period required by section 111 b.; and

Whereas section 111 b. contains a proviso that each such proposed arrangement will be entered into in accordance with the program justification data previously submitted to the Joint Committee on Atomic Energy in support of authorization legislation; and

Whereas the homogeneous type of reactor proposed to be constructed is considered a promising reactor concept; and

Whereas the Joint Committee on Atomic Energy and the Congress approve of private industrial participation in the power demonstration reactor program so long as the arrangements are in accordance with the requirements of law, as in other proposed arrangements: Now, therefore, be it

Resolved by the Senate (the House of Representatives concurring), That—

(1) the basis of the proposed arrangement between the Atomic Energy Commission and the Pennsylvania Power and Light Company and Westing-

house Corporation is not properly before the Joint Committee on Atomic Energy, and the forty-five day period will not begin to run until a basis has been submitted which is in accordance with the program justification data of the third round of the Atomic Energy Commission power demonstration program; and

(2) the proposed arrangement is not consistent with the program justification data of the third round as previously submitted to the Joint Committee in that it

a. does not contain an obligation on the part of the proposers to construct and operate the reactor;

b. does not provide for adequate protection of the public interest in connection with patent rights on discoveries made during design and construction of the reactor;

c. does not provide for resubmission of the basis to the Joint Committee and the Congress in the event a decision is subsequently made to construct and operate the reactor; and

d. contains retroactive features which may circumvent the intent of section 111 b. of Public Law 85–162 unless specifically authorized.

(3) The Congress hereby declares it necessary and advisable for the Atomic Energy Commission to withdraw its proposed arrangement numbered 58–111–6 and resubmit the basis of the arrangement in a manner consistent with Public Law 85–162.

[Telegram]

APRIL 2, 1958.

Hon. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
The Capitol, Washington, D. C.:

Following is a self-explanatory telegram which I have just sent to Mr. Holifield as chairman of Joint Committee Subcommittee on Legislation.

"Senator Anderson's proposed resolution and remarks of yesterday have just been brought to my attention. On the chance that our position may not have been manifestly clear in the testimony given in hearings on March 22, I wish to state unequivocally that this company would not proceed with the homogeneous reactor project as proposed to the AEC unless the project had the approval of your committee. I tried to make clear in the hearings that we were anxious that procedures for considering and acting on our project should be worked out in a manner satisfactory to your committee as well as AEC. We understand that efforts are now being made to that end. For our own part even if such procedures have not been worked out by the expiration of the 45 day period and regardless of the legalities of the situation, we would not be satisfied to proceed with this project if it did not meet with the approval of your committee. I am sending copies of this telegram to Senator Anderson and also to AEC, as well as to chairman Durham and Mr. Van Zandt."

PRESIDENT, PENNSYLVANIA POWER & LIGHT CO.

[Telegram]

APRIL 3, 1958.

Mr. JACK K. BUSBY,
President, Pennsylvania Power & Light Co.,
Allentown, Pa.:

Reurtel do not question the willingness of your company to delay starting of homogeneous reactor project until Joint Committee is satisfied. However, because of our experience with transfer of plans covering *Nautilus* submarine to British would not feel we could rest on our rights. My resolution not intended to be unfriendly but merely to protect 45-day situation.

CLINTON P. ANDERSON,
United States Senator.

UNITED STATES ATOMIC ENERGY COMMISSION,
April 16, 1958.

HON. CARL T. DURHAM,
Chairman, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. DURHAM: This letter is in further reply to your letters of March 28 and March 31, 1958, regarding the proposed cooperative arrangement with Pennsylvania Power & Light Co.-Westinghouse Electric Corp. under the third round of the power demonstration program.

In consideration of the questions raised in your letters and the opinion expressed by the Comptroller General in his letter to Congressman Holifield, dated April 8, 1958, we have concluded that it is advisable to seek specific authorization for an arrangement with the proponents on a revised basis. Accordingly, we propose to forward to both Houses of the Congress a request for legislative authorization.

In view of this action, we hereby withdraw the program justification data No. 58-111-6 submitted with our letter of February 24, 1958, and our request for waiver of the 45-day filing period provided by section 111 (b) of Public Law 85-162.

Sincerely yours,

LEWIS STRAUSS, *Chairman.*

[Atomic Energy Commission press release, Washington, D. C., April 16, 1958]

AEC WILL ASK SPECIFIC AUTHORIZATION FOR PPL–WESTINGHOUSE POWER REACTOR PROJECT

The Atomic Energy Commission today advised the Congressional Joint Committee on Atomic Energy that it will forward to the Congress a request for specific legislative authorization of a cooperative arrangement with Pennsylvania Power & Light Co. and the Westinghouse Electric Corp. for Commission assistance to the companies' power reactor project. The Commission withdrew its earlier submission of the project under the terms of the 1957 legislation generally authorizing cooperative arrangements for assisting power reactor projects.

The Commission stated that it was changing to the specific authorization in the light of the questions raised in the committee and an opinion from the Comptroller General.

(For subsequent hearing where AEC requested specific authorization of Phase I only, of this proposed project, see hearings on AEC Authorizing legislation, June 10, 1958.)

(Thereupon, at 3:35 p. m., Saturday, March 22, 1958, the committee recessed, to reconvene Friday, May 23, 1958, at 10 a. m.)

REVIEW OF PROPOSALS UNDER POWER DEMONSTRATION PROGRAM

FRIDAY, MAY 23, 1958

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON LEGISLATION,
JOINT COMMITTEE ON ATOMIC ENERGY,
Washington, D. C.

The subcommittee met, pursuant to call, at 10 a. m. in room 304, Old House Office Building, Hon. Chet Holifield, chairman of the subcommittee, presiding.

Present: Representatives Holifield, Durham (chairman of the joint committee), Price, and Hosmer.

Aso present: James T. Ramey, executive director; David R. Toll, staff counsel, Joint Committee on Atomic Energy; and Bernard V. Dvoskin, GAO consultant.

Representative HOLIFIELD. The subcommittee will be in order.

The Subcommittee on Legislation of the Joint Committee on Atomic Energy is meeting this morning to receive testimony from AEC representatives concerning the bases of three proposed cooperative arrangements for nuclear power projects submitted to the joint committee in accordance with section 111 b. of Public Law 85–162.

These three proposed projects are as follows: The Carolinas-Virginia Nuclear Power Associates, under the third round of the power demonstration program; the city of Piqua, Ohio, and Rural Cooperative Power Association, of Elk River, Minn., under the second round of the power demonstration program.

As soon as this hearing was scheduled, I sent telegrams to representatives of the three projects, including the reactor manufacturers, informing them of the meeting, and inviting them to be present and testify today if they so desire.

Before we have the witnesses for the AEC, I see that we have Senator Thurmond, of South Carolina, here, and the first one of the projects we are going to consider is the Carolinas-Virginia Nuclear Power Associates project, which is a matter of great concern to him and to his constituents. We would invite you, sir, at this time to come forward and make a statement, if you wish.

STATEMENT OF HON. STROM THURMOND, A UNITED STATES SENATOR FROM THE STATE OF SOUTH CAROLINA

Senator THURMOND. Thank you, Mr. Chairman.

Chairman Holifield and Chairman Durham, I have a very brief statement. I shall make my remarks brief and to the point. My purpose in appearing here this morning is to urge that the committee

waive the usual 45-day review period and give approval for the Parr Shoals project to enter its construction phase at the earliest possible moment.

This is the kind of project that should be encouraged and supported by every citizen. It is a partnership arrangement, a joint venture shared by the Government and private enterprise. It is not an intrusion by Government into the free-enterprise system, but, rather, this is a joint effort to develop atomic energy for peaceful purposes.

The construction of the Parr Shoals project is an important step in the development of a nuclear-power system that will eventually cover the entire Southeast. We all agree, I believe, that we should aim to develop such a power system. The only question, in considering any specific step in that direction, is to consider whether that particular step is a sound and feasible one. In the case of the Parr Shoals project, there is general agreement that this is a wise and timely step.

At the present time, the general economic recession has had an adverse effect on the economy of the area in South Carolina in which the Parr Shoals plant will be built. The citizens of Fairfield County and the counties adjoining are looking forward to an improvement in the economic situation there when this large construction project gets underway. In my opinion, the sooner we can bring about this stimulus to the economy the greater the beneficial effect.

Finally, I would like to emphasize the fact that the Virginia-Carolinas group is ready to get underway with this undertaking. If the waiting period can be waived, there need be no further delay.

I, therefore, urge that the committee give its consent to the request that the review period be waived.

Mr. Chairman, that is my statement.

I want to say Mr. W. B. McGuire, from Charlotte, with the Duke Power Co., attorney for the CVNPA, the Carolinas-Virginia Nuclear Power Associates, is here to answer any questions that you care to ask of him, as well as Mr. Miller, the executive vice president of this group, and also Mr. E. C. Fidd, the engineering director of this group, and Dr. Schoup, from Westinghouse, who is contractor for this project, and Mr. Ben Martin, who attended Clemson College shortly after I was there, about the same time, who is also with Westinghouse. They will be pleased to answer any questions this morning the committee has.

I am not going to take up your time. Thank you very much for your courtesy in permitting me to come over and make this brief statement.

I certainly want to say that the people of my State are vitally interested in this project. We feel that it is a good project, a sound project, a feasible project, and it is the proper approach in this matter.

Thank you very much.

Representative HOLIFIELD. Thank you very much for your testimony, and we assure you that the committee will give this very careful consideration. We appreciate your interest in the matter.

We also have in the room this morning our colleague from North Carolina, Congressman Jonas. Congressman Jonas, would you care to make a statement at this time?

STATEMENT OF HON. CHARLES RAPER JONAS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NORTH CAROLINA

Representative JONAS. Thank you, Mr. Chairman. I did not come over to ask permission to testify, but, since you give me the opportunity to do so, I would like to make one brief statement. I think I could summarize all that I want to say by asking that I be permitted to associate myself with the remarks made by the Senator from South Carolina.

While the project is to be built in South Carolina, the Duke Power Co. and other companies in North Carolina and Virginia are interested in it, and the people in my district are anxious to see this project get underway at the earliest possible date. I do not think that I could add anything to what the Senator has said. We are very much interested in it.

Private capital is available; the company associates are ready to proceed, and, if the committee can use its good offices in expediting the plans that have to be made, the people in the district that I represent will be very pleased at this development.

Representative HOLIFIELD. Thank you, sir. We appreciate your interest in the program of your State.

Now, our AEC representatives this morning are Mr. K. E. Fields, General Manager, Mr. W. K. Davis, Director of the Division of Reactor Development, and Mr. Delmar M. Morris, Assistant Director for Administration, Division of Reactor Development.

Mr. Davis or Mr. Fields, which of you gentlemen wish to proceed?

Mr. FIELDS. I believe Mr. Davis will.

Representative HOLIFIELD. Mr. Davis, you may proceed with your statement.

STATEMENTS OF K. E. FIELDS, GENERAL MANAGER; W. K. DAVIS, DIRECTOR OF THE DIVISION OF REACTOR DEVELOPMENT; DELMAR M. MORRIS, ASSISTANT DIRECTOR FOR ADMINISTRATION, DIVISION OF REACTOR DEVELOPMENT; AND EDWIN FERGUSON, DEPUTY GENERAL COUNSEL, ATOMIC ENERGY COMMISSION

Mr. DAVIS. Mr. Chairman and members of the committee, we appreciate your holding a hearing today to discuss the three proposed cooperative arrangements for nuclear-power projects submitted in accordance with section 111 b. of Public Law 85–162.

Two of these projects, the Rural Cooperative Power Association, which also involves a contract with ACF Industries, Inc., for design and construction of the reactor, and the city of Piqua, Ohio, which also involves a contract with North American Aviation for design and construction of the reactor, were submitted under the second round of the Commission's power demonstration reactor program. The third project, the Carolinas-Virginia Nuclear Power Associates, was submitted under the third round of the program.

The program justification data for the RCPA and Piqua arrangements were submitted to your committee on April 30, 1958, with a request that the Joint Committee waive the 45-day review period for which section 111 (b) of Public Law 85–162, requires cooperative undertakings to be before the committee. The program justification

data for the proposed CVNPA cooperative arrangement was transmitted to your committee on May 16, 1958.

The original CVNPA proposal contained certain provisions which would have necessitated special authorization of the project. However, recent discussions with the associates produced a number of revisions to the proposed arrangements which brought the resulting agreement into line with the terms of the third round of the power demonstration reactor program and the proposed arrangement was, therefore, submitted to you on that basis.

The basis of the RCPA arrangement previously was submitted to the Joint Committee for review on September 16, 1957, with American Machine & Foundry as the principal development and construction contractor. As you know, AMF withdrew its offer prior to formal consideration of the proposed arrangement by your committee, and ACF Industries, Inc., was selected as the succeeding contractor for development and construction.

We are prepared to discuss the technical and contractual aspects of each of the proposed projects, and to answer any questions you may have with respect to them in such order as you wish.

I have a separate statement here on each of the three projects. I can cover them all at one time or we can take them one by one.

Representative HOLIFIELD. Let's cover them one at a time. Begin with the Carolina-Virginia project.

(The program-justification for the project follows:)

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58-111-9

A. Name of contractors

1. *Prime contractor.*—Carolinas Virginia Nuclear Power Associates, Charlotte, N. C. (consisting of the Duke Power Co., Carolina Power & Light Co., South Carolina Electric & Gas Co., and the Virginia Electric & Power Co.).

2. *Principal subcontractors.*—Westinghouse Electric Corp., for preoperation research and development, design, and manufacture of the nuclear plant.

Stone & Webster Engineering Corp., engineering and construction agent.

B. Description of proposed project

1. *Objective.*—The objectives of the proposed project are to bring new resources into the development of nuclear-power technology, to advance the art, and to accelerate the time when economically competitive nuclear power is achieved. These objectives are to be achieved by a proposed arrangement which, on the terms given below, is directed to the construction and operation of a heavy water-cooled and heavy water-moderated pressure-tube type reactor plant fueled with slightly enriched (approximately 2 percent) uranium, and designed as a prototype for a large-scale plant wherein operation with natural uranium may be feasible. The prototype nuclear powerplant will include a conventional-fuel-fired superheater and will be designed for delivery of steam to generate at least 17,000 net kilowatts of electricity.

2. *Location.*—The proposed plant will be located at Parr, S. C.

3. Technical aspects (*data are approximate*).—

Heat output: 60.5 megawatts.
Electrical output: 17 megawatts.
Type of fuel and amount: 3,410 kilograms UO_2.
Enrichment percent U–235: 2.0 percent.
Moderator: D_2O.
Coolant: D_2O.
Reactor outlet temperature: 575° F.
Reactor pressure: 1,500 p. s. i. a.
Steam conditions: 700 p. s. i. a., 503° F., 203,000 pounds per hour.

4. *Estimated date of completion.*—June 30, 1962.

c. Estimates of costs (in thousands):

	Allocation of estimated costs	
	AEC	CVNPA
1. Preoperation research and development	[1] [2] $8,485	
2. Design, fabrication, construction, and startup:		
Reactor		[3] $18,141
First core		1,000
Subtotal		19,141
3. Postconstruction costs:		
Research and development	[1] [4] 3,132	190
Excess operating costs		[5] 6,077
Lease of plant site		400
Subtotal	3,132	6,667
4. Escalation:		
Preoperation research and development	[6] 1,660	
Design, fabrication, construction		[7] 3,000
Postconstruction research and development	[6] 628	
Subtotal	2,288	3,000
5. Use charges:		
Waiver of fuel use charges	[8] 750	
D_2O use charges		[9] 420
6. Grand total	14,655	29,228

[1] This is a ceiling amount. If research and development costs exceed the ceiling, CVNPA will bear the excess.
[2] $8,305,000 is subject to escalation, limited to 20 percent if upward.
[3] Does not reflect value of existing generating plant.
[4] Subject to escalation, limited to 20 percent if upward.
[5] Includes $315,000 for D_2O losses, purification, and insurance.
[6] Limited to 20 percent if upward.
[7] Estimated escalation.
[8] This is a ceiling.
[9] Assumes AEC policy will provide for leasing of D_2O.

D. General features of proposed arrangements

1. Site.—The site for the nuclear powerplant will be subject to approval by AEC.

2. Construction.—The nuclear powerplant will be constructed by CVMPA. The major portion of the preconstruction research and development, design, and manufacture of the nuclear plant will be subcontracted to Westinghouse Electric Corp. Stone & Webster Engineering Corp. will be the engineering and construction agent.

3. Operation.—CVNPA will operate the nuclear powerplant for 5 years in conjunction with the system of the South Carolina Electric & Gas Co., 1 of the member companies sponsoring CVNPA, with which the other member companies are interconnected.

4. Financial assistance.—AEC will provide preoperation research and development assistance up to a maximum amount of $8,485,000. Of this total, $8,305,000 will be subject to escalation, limited to 20 percent if upward, based on an appropriate standard index and on the submission date of the proposal. Also, AEC will provide a maximum $3,132,000 in postconstruction assistance which will be subject to similar escalation. The maximum escalation cost to AEC under the above would be $2,288,000. Up to $500,000 of the above research and development may be performed in AEC facilities, if private facilities are not available.

AEC also will waive fuel use charges up to a ceiling of $750,000. In addition, AEC will waive $420,000 heavy water use charges applicable to the reactor operating period, if AEC receives the necessary legislative authority.

Research and development costs to be reimbursed by AEC will include costs incurred by CVNPA on and after the date that the Joint Committee on Atomic Energy's statutory 45-day review period for the proposed cooperative agreement lapses or is waived, whichever is earlier.

5. Title.—CVNPA will be the sole owner of the nuclear powerplant.

6. Term.—The term of the contract will extend until the expiration of 5 years after the issuance by AEC of a license to operate the facility.

7. *Indemnity.*—As a licensee of the Commission, CVNPA will be subject to the provisions of Public Law 256, 85th Congress.

8. *Option to purchase.*—AEC will have the right to purchase the nuclear facilities at any time after foundation pouring begins if CVNPA fails to continue the project for any reason other than termination by (*a*) mutual agreement, or (*b*) CVNPA's inability to obtain necessary licenses, regulatory agency approvals, or adequate liability insurance coverage.

9. *Termination.*—The contract may be terminated at any time by written agreement of the parties. Any such termination shall be effective in the manner and upon the date specified in said termination agreement.

CVNPA may terminate the contract at any time by written notice to AEC if construction or operation of the plant is made impossible by CVNPA's inability to obtain necessary licenses or regulatory agency approvals, or by its inability to obtain adequate liability insurance coverage. The contract also will terminate if there is mutual agreement that results of research and development demonstrate that it would not be technically feasible to proceed with construction and operation. In any of these cases, neither AEC nor CVNPA shall be required to reimburse the other for any costs or expenses by reason of the termination of the contract, other than for costs and expenses which have previously been incurred by CVNPA and for which it is entitled to reimbursement under the provisions of the contract.

10. *Patents.*—AEC will receive a nonexclusive, irrevocable, royalty-free license for governmental purposes on atomic-energy inventions arising out of the work supported by the proposers. AEC will receive all rights to inventions arising out of AEC supported research and development work, except that CVNPA and each member company, and/or each subcontractor with respect to its own contract, will receive a nonexclusive, irrevocable, royalty-free license. CVNPA and/or its subcontractor also will receive outfield rights on inventions in areas where they have established patent position. All subcontract patent provisions will be subject to AEC approval.

11. *Licenses.*—CVNPA undertakes to obtain all necessary licenses from the Commission, and such other necessary approvals from Federal, State, and local regulatory agencies as are required to permit the construction and operation of the plant and the sale or use of the energy produced therein.

12. *Information and records.*—The proposers will keep available for AEC inspection and study, and require their subcontractors to keep such records of technical, economic, and financial data as will enable AEC to carry out the purposes of the power demonstration program. The proposers also will supply, and will require their subcontractors to supply, to AEC for such purposes such data as AEC may reasonably request. The Commission and its representatives will have the right to inspect and audit the work, records, reports, information, data, and activities of CVNPA and its subcontractors under the project. The contract also will include the statutory GAO audit provision.

13. *Organization and financing.*—The financial responsibilities of CVNPA to carry out its obligations under the definitive contract with AEC would be backed up respectively by agreements to be made between CVNPA and its members, severally, and no member would be responsible for the obligations of any other member. Copies of such agreements will be furnished to AEC prior to execution of the definitive contract and will not be changed without the approval of AEC; except that any member company may assume the obligations of another upon demonstration of financial ability to the satisfaction of AEC.

Mr. DAVIS. The Carolinas-Virginia Nuclear Power Associates propose to build and operate a heavy water moderated and cooled, low enrichment uranium dioxide fueled nuclear powerplant of 60.5 thermal megawatts capacity, utilizing a vertical pressure tube-type of construction. The steam produced by the reactor will be fed via an oil-fired superheater to an adjacent existing conventional power station.

The use of pressure tubes rather that the more conventional pressure vessel offers several interesting advantages, the most important of which is the lack of a size limitation imposed by fabrication methods. It is simpler, mechanically speaking, to build more tubes than to build a large pressure vessel.

It is important to the future of our heavy water reactor program that a reactor of this type be built and operated as an electrical generating station under normal operating conditions since this is the only certain method of obtaining the data on operating reliability, operational problems, and heavy water losses that are essential elements in determining power costs.

The Commission currently is supporting a broad research and development program in the field of heavy water reactors and is maintaining close coordination with the Canadian heavy water program.

As part of the Commission's program, the plutonium recycle test reactor (PRTR) is being built at Hanford to develop methods of using plutonium-bearing fuel elements in heterogeneous thermal reactors.

This reactor, which bears some similarity to the CVNPA reactor, will utilize plutonium enrichment with natural uranium feed and will not be utilized for the production of electric power but will be operated principally as a test reactor.

The Hanford reactor has been designed to provide a large degree of flexibility and the proper conditions for fuel element testing. There will, of course, be some useful information on heavy water power reactors developed in the course of the Hanford work and this information will complement the CVNPA program.

Although the CVNPA reactor in the size presently proposed would require some enrichment of the fuel—approximately 2 percent—it is designed as a prototype for a large-scale plan wherein operation with natural uranium may be feasible.

The principal provisions of the proposed contractual arrangements, including the undertakings and financial commitments of the parties, are set forth in the program justification data sheet. As indicated there, the total financial assistance to be provided by AEC is $14,655,000, and the estimate cost to the proposers for development, construction, and 5 years of operation is $29,228,000.

Representative HOLIFIELD. Are there any questions from the committee?

Chairman DURHAM. Mr. Chairman, the notice of the proposal submitted on August 23, 1957, gave a completion date of June 30, 1962, based on a "reasonably prompt acceptance by the AEC." It is now 9 months since the proposal was submitted and the completion date is still shown as June 30, 1962.

The question, Dr. Davis, is: Is the Commission satisfied that this date is a reasonable one for completion? If not, does it comply with the announcement of the third round?

Mr. DAVIS. This is one of the questions we have discussed with the associates, and they have in turn, I believe, talked with their engineering subcontractors, and they have assured us that they believe the schedule can be held to allow competion of construction by June 30, 1962.

This is a fairly tight schedule. Our judgment is that there is a pretty good chance of making it.

Chairman DURHAM. You have been assured, then, by the prime contractor it can be done?

Mr. DAVIS. We have been assured by the group that they believe it can be done; yes, sir.

Chairman DURHAM. And that firm is who—Stone & Webster?

Mr. MORRIS. Stone & Webster, and Westinghouse. Both provided the associates, who in turn have provided us, with letters very recently stating they have reexamined this and believe it is feasible and reasonable to expect completion by June 30, 1962. Our own engineers have also looked over this schedule and believe it is reasonable of accomplishment.

Chairman DURHAM. That gives you about 2 years and what? How many months?

Mr. DAVIS. Four years, Mr. Durham.

Chairman DURHAM. Oh, yes; 4 years.

Mr. Chairman, I think that is all the questions I have.

Representative HOLIFIELD. What research and development work has been done on this project to date, Mr. Davis?

Mr. DAVIS. There has been none carried out specifically under this project, since we do not yet have an arrangement with them.

Representative HOLIFIELD. Does the reduction of $820,000 from the original proposal have anything to do with work which has already been done but which has not been allocated to this project?

Mr. MORRIS. No, sir.

The principal explanation for that reduction is the shifting from AEC account to the associates' account of the cost of the first core.

Representative HOLIFIELD. On that point, should the core be considered as part of construction or is it an operating cost essentially?

Mr. MORRIS. It is viewed as an operating cost, and that is why the adjustment was made to reduce the amount of AEC assistance represented by the cost of the first core and transferred to their own account.

Representative HOLIFIELD. So that, in effect, is an additional funded item which should be added to the $14,655,000? Or is it included?

Mr. MORRIS. It is to be paid by the associates now.

Representative HOLIFIELD. It is to be paid by them.

Mr. DAVIS. Of course, there has been a great deal of research and development which has been in process in the last roughly 2 years on the various types of heavy-water reactors. This has been going on at Du Pont, and certainly Westinghouse has been making some studies of this on their own account.

Chairman DURHAM. That is the work you have been doing down at Savannah River?

Mr. DAVIS. At Savannah River, and to some extent up in Wilmington, Del., their engineering headquarters.

Representative HOLIFIELD. Is that general research and development work available to everyone?

Mr. DAVIS. That is correct, sir.

Representative HOLIFIELD. Under your third round announcement, you listed the natural uranium-fuel heavy-water moderated reactor as one of the types the AEC would request Federal financing for if no acceptable offer was received from industry.

You do not consider the Carolinas-Virginia proposal to offset this particular type, do you?

Mr. DAVIS. No, sir, Mr. Holifield.

Representative HOLIFIELD. This is considered separately because of the difference in fueling?

Mr. DAVIS. There is also——

Representative HOLIFIELD. Enriched fuel and not natural uranium?

Mr. DAVIS. This reactor, although it might be considered a prototype for an eventual natural uranium reactor is not itself a natural uranium reactor and will require about 2 percent enrichment in order to operate.

Representative HOLIFIELD. Your $420,000 which you estimate is a waiver of heavy water costs, is that a ceiling or is it just an estimate in which you may have an overrun?

Mr. MORRIS. This is an estimate. The $420,000, as you know, is listed in the column of costs to be borne by the associates.

However, as we have noted in paragraph D4 of the program justification data, it is expected that AEC would waive the use charge on this if our pending request for legislative authority to do so is enacted.

Representative HOLIFIELD. This is an item that is dependent upon legislation for these types of reactors?

Mr. DAVIS. That is correct, sir.

Mr. MORRIS. The arrangement between AEC and the associates with respect to this item is dependent upon that legislative action.

Mr. TOLL. May I ask a question?

Representative HOLIFIELD. Go ahead.

Mr. TOLL. The way you have your sheet shown, it assumes there would be no legislative action and this item is listed as a cost to the proposer; is that correct?

Mr. MORRIS. At the present time it has to be in their account.

Mr. TOLL. Therefore, if the legislation were enacted, their participation would be reduced from the figure shown here; is that correct?

Mr. MORRIS. Yes.

Mr. FIELDS. And it would appear in the AEC column.

Representative HOLIFIELD. We see in your terms there is an option to purchase any time during the 5 years, if the CVNPA fails to continue the project for any reason other than termination by mutual agreement or inability to obtain the necessary license or adequate liability insurance.

In that case, assuming the work has progressed, is the AEC obligated to repay the CVNPA for the contribution they have made up to that time, or do they just take over and finish it?

Mr. MORRIS. It is expected that a price would be negotiated if we exercised this option.

Representative HOLIFIELD. What certainty do we have that the CVNPA will go through with the deal?

Mr. MORRIS. This option would only apply in case there is default of the contract.

Representative HOLIFIELD. And default would only be on those terms that are included here?

Mr. MORRIS. The understanding, Mr. Holifield, is that this is a provision that would be applicable in case of default without prejudice to any rights the AEC might have if there was default of the contract by CVNPA.

Chairman DURHAM. Is there any difference in that and the contracts we have made heretofore?

Mr. MORRIS. This provision is very similar to a similar option that appears in the Yankee contract, the Northern States, and the PRDC.

Chairman DURHAM. That is what I thought. That means, of course, the 4 companies would have to fail, not just 1 of the companies pull out. Would that be true? It is a separate corporation, is it not?

Mr. MORRIS. We are contracting with the associates, which is a separate corporation backed up by commitments from the four member companies.

Chairman DURHAM. That would not make any difference, then.

Mr. MORRIS. As long as the associates met their obligations under the contract this would not come into play.

Chairman DURHAM. That is right.

Representative HOLIFIELD. Will you explain paragraph 10 in regard to patents?

Mr. MORRIS. If you have in mind the research and development information——

Representative HOLIFIELD. The rights to be received, it says here in connection with paragraph 10 on patents, are outfield rights to be received by the group and its subcontractors.

Will you please describe that? What is your understanding of the patent rights to the Government?

Mr. MORRIS. Basically, the AEC will receive title to inventions arising out of the work AEC pays for and will give to CVNPA and/or its subcontractors nonexclusive irrevocable royalty-free license, and they will also receive certain outfield rights in inventions in certain areas where they have established patent position.

That is to say, in connection with components that are outside of the reactor proper, items such as motors and pumps, and only with regard to standard applications of those standard type components.

Representative HOLIFIELD. That is where they have established that by the expenditure of their own money and established an independent patent position?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. Without the utilization of any Federal financing?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. In those particular fields I am speaking of.

Mr. MORRIS. It is standard types of equipment.

Representative HOLIFIELD. That is what you mean by outfield rights?

Mr. MORRIS. Yes, sir.

Mr. TOLL. On those so-called outfield items, would there be any Government financing on those?

Mr. MORRIS. No; these would be patents on items of equipment on which they have an established position. That is, to give an example in this case, if Westinghouse uses in this a pump similar to one which they have developed themselves and normally sell, they would have the right to the patents on such equipment.

Chairman DURHAM. And if you improved a heavy water tube or something like that, where you had invested money in it, the patent rights would accrue to the United States Government?

Mr. MORRIS. Yes.

Representative HOLIFIELD. Where there was a mingling of Federal and private funds?

Mr. MORRIS. For these particular items that I have been talking about, even though they may have developed an improvement to something they previously had developed themselves with funds under this project, they would have the right to such equipment.

Representative HOLIFIELD. Let me understand that. They have a basic patent on a tube, for instance, and then with mingled funds, private and Federal funds, they evolve an improvement. Are you telling the committee that this would give the CVNPA the right to file on that improvement, notwithstanding Federal funds were involved?

Mr. MORRIS. That is my understanding, sir. Perhaps our counsel could clarify this.

STATEMENT OF EDWIN FERGUSON, DEPUTY GENERAL COUNSEL, ATOMIC ENERGY COMMISSION

Mr. FERGUSON. I am Edwin Ferguson, Deputy General Counsel of the Commission.

We have normally in contracts of this type in our patent provisions a provision under which the contractor does retain these outfield rights with respect to improvements on inventions that are under his basic patent even though the Government finances the work.

In those cases normally, however, the Government also retains a license to use the invention for governmental purposes.

I am not acquainted with the details of this negotiation enough at this point to answer the question of whether that additional caveat is applicable to the patent provision now negotiated.

Representative HOLIFIELD. What would prevent you, then, from taking part of the $14 million of research and development which is furnished by the Government and utilizing that to improve devices on which you already have basic patents, and then accrue to your private advantage such improvements—and this is a rapidly growing art—for your own private patent designs?

Mr. FERGUSON. I suspect the answer to that question, Mr. Holifield, lies in the control we have over the direction of the research and development work.

Representative HOLIFIELD. That is not an answer to me. Because you have direction of the research and development work; is that what you said?

Mr. FERGUSON. Yes, sir; that is what I said.

Representative HOLIFIELD. Then it will not be done in Government laboratories but it will be done with Government money?

Mr. FERGUSON. Under the programs that the Government approves.

Mr. DAVIS. Our arrangement calls for the Commission to approve the research and development programs to be carried out as a part of this, and this is because of the fact that there are already programs in this field at Savannah River and other places and we want to be assured there is no unnecessary duplication of work there.

It would also serve the purpose of making sure that the money is not spent merely to improve the patent position of the people doing

the work. This is the kind of control that we have over these particular development programs.

Representative HOLIFIELD. Do you consider you are guarding the taxpayers' interest when you furnish millions of dollars for research and development and include in the contract a waiver of such patent equities as may be developed by the expenditure of public funds?

Mr. DAVIS. This, as I understand it, would only be in this one area. Basically, the——

Representative HOLIFIELD. Regardless of how many areas it is in, the principle is involved.

Mr. DAVIS. This, as I understand it, is a normal patent position, or type of a patent arrangement that the Commission makes on research and development contracts and is consistent with the basic policy of the Commission that it will take and dispose of the patent rights for things for which it pays.

But it does in some cases allow the people in areas where they already have established a patent position, where they have already done a great deal of their own work, to take these rights in what is called the outfield, which is the area not directly connected with the atomic-energy business.

Chairman DURHAM. You are, in effect, saying to us, of course, the research and development work already done would extend, as far as the AEC's rights are concerned, in the improvement of something that you have already done basic research work on.

If it happened to be improved because of the fact it is in this reactor, you would still retain the AEC's authority on the patent rights?

Mr. DAVIS. Yes; I believe that is right.

Chairman DURHAM. If I understand it correctly.

Representative HOLIFIELD. I understand it differently. I understand if the private company has a basic patent and the AEC furnishes several million dollars in research and development on this particular reactor, and if part of that money is spent and it results in patentable improvement on the basic patents, that without any compensation the private company is granted these additional patent rights which have been paid for, in effect, by Government money. That is the way I understand it.

Mr. FERGUSON. Mr. Holifield, I think perhaps that is where we are a little bit at odds here.

What we are talking about here is a mixed situation in which the Government is putting up some money for research and development, the private company is putting up some money for research and development. Only in this situation is our patent position that the company may be entitled to some outfield rights.

I would gather what you are thinking about is a situation where only the Government is putting up the research and development money.

Representative HOLIFIELD. No. It says a mingling of Government funds.

There goes with it the mingling of Government equity, and I would assume by that the majority of the funds that are being put up by the CVNPA is for construction, and the majority of the money that is put up by the AEC is for research and development, with some for waiver of fuels charge.

But the big item is preoperation research and development, $8,485,000, and you have research and development in the postconstruction period of $3,132,000. You have certain escalation clauses in there which allow this research and development to go up another $2,288,000.

The only element which has nothing to do, as I see, with research and development is the $750,000 estimate for waiver of fuel-use charge.

So, in effect here, you have got close to $14 million in research and development which is being put into this project. On the other hand, you are putting in $29 million, and I would assume that is the private participation which is mostly for construction.

Mr. FIELDS. And operation.

Representative HOLIFIELD. And operation.

I am talking about a principle that is involved here, and I do not care whether I am talking to the representative of the company or the representative of AEC. If it is the representative of AEC, it is all the more reason for you to protect the Government's interest. I am not saying you are not, but I am asking for an explanation because it seems to me there is an equity that is developed there as a result of Government funds which should be protected in some way. We should have some compensation for that.

If they are entitled to it, it should be on the basis of negotiation and an offsetting compensation for some of the moneys we are spending out of the public funds.

Mr. DAVIS. Mr. Holifield, one thing here in the outfield rights we are talking not about the applications to nuclear powerplants. Insofar as the research and development which is directed toward, and is intended to be directed toward, the development of nuclear powerplants is concerned, the Commission will get the rights in those inventions completely. It is only this so-called outfield, which is the application aside from this infield, in which the companies already have a position.

Representative HOLIFIELD. I think I understand it.

Let's assume that the private party has a private patent position on a pump and you want to change that pump and adapt that pump for the nuclear reactor, and you spend a million dollars of Government money adapting that pump for the nuclear reactor.

Then, as I understand it, according to your contract, this is considered an outfield patent improvement and it is granted to the company without any quid pro quo or any compensation from the company.

Mr. DAVIS. Except presumably they have already done the basic development of the pump, and it is being used then in the atomic-energy work.

It is true under this kind of arrangement they would be able to use also the inventions in using this pump for other purposes. So it is really a trade of the work they have done in the past on developing it basically for the ability for them to use it in other applications later on.

Representative HOLIFIELD. But the AEC does not achieve the right to use it in other nuclear plants unless they are built by the Government solely. Am I not right?

You grant them the outfield use but you do not receive the infield use in nuclear plants except those that are financed solely by the Government?

Mr. DAVIS. That is true.

Mr. MORRIS. This right that they receive is only for nonnuclear applications.

Representative HOLIFIELD. Are you sure of that?

Mr. MORRIS. That is my understanding, sir.

Representative HOLIFIELD. Let's just go into that a little bit.

Let us assume that X private company out here wants to build a reactor and later on they want to use this adapted pump which is peculiarly adaptable in a nuclear reactor. Does the AEC have any right to grant to that new private company the rights to use this pump?

Mr. MORRIS. I believe so for a reactor plant, a nuclear plant.

Representative HOLIFIELD. I do not think you do have under your contract here. I would like for you to explore that and later on report to the committee on that point.

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. I have no objection to the company using in nonnuclear fields an improvement of this type, but if it comes to other private plants in the nuclear industry, why, it would seem to me that the public funds which we are spending for the advancement of the nuclear art should be available to other private companies without patent rights, except for the basic patent royalty which is involved in the original pump.

You can give us a separate report on that by letter, if you will, please.

Mr. FIELDS. Right.

Representative HOLIFIELD. This whole field of patents should be explored a little more thoroughly, it seems to me.

What is the breakdown of the financial responsibilities of the members of the group?

Mr. MORRIS. I am sorry I do not have that readily available.

Representative HOLIFIELD. Will you supply that for the record?

Mr. MORRIS. Yes; I will.

(The letter referred to follows:)

UNITED STATES ATOMIC ENERGY COMMISSION,
Washington, D. C., May 28, 1958.

HON. CHET HOLIFIELD,
Chairman, Subcommittee on Legislation, Joint Committee on Atomic Energy, Congress of the United States.

DEAR MR. HOLIFIELD: In the course of the hearing of the Subcommittee on Legislation, conducted on May 23, 1958, into the proposed cooperative arrangement between Carolinas-Virginia Nuclear Power Associates and the Atomic Energy Commission, you requested clarification of the provisions to be included in the agreement concerning the subject of patents.

This will advise you that we have reached an understanding with Carolinas-Virginia Nuclear Power Associates that the following patent arrangements will be incorporated into the proposed agreement:

AEC will have the right to ownership of all inventions or discoveries made or conceived in the course of, in connection with, or under the terms of the contract and all subcontracts. CVNPA, each member company and/or each subcontractor (with respect to his own subcontract) shall receive—

(1) a sole (except as against the Government or its account), irrevocable, royalty-free license with the sole right to grant sublicenses with respect to inventions which relate to a field in which such company or subcontractor has an established industrial and patent position, such license being limited to uses other than use in the production or utilization of special nuclear material or atomic energy; and

(2) a nonexclusive, irrevocable, royalty-free license to use the inventions described in (1) in the production or utilization of special nuclear material or atomic energy.

AEC also will receive a nonexclusive, irrevocable, royalty-free license to all inventions which CVNPA, its member companies and/or any subcontractor owns, or in which it has the right to accord licenses, that are utilized or embodied in the nuclear reactor, limited to use in the manufacture and use of Government-owned or Government-operated reactor facilities of a type similar to that constructed under this contract.

All subcontract patent provisions will be subject to AEC approval.

We trust that this will be found acceptable as a restatement of the patent arrangements set forth in paragraph D, 10, of the program justification data for arrangement No. 58–111–9 with Carolinas Virginia Nuclear Power Associates.

Sincerely yours,

K. E. FIELDS, *General Manager.*

Representative HOLIFIELD. Has Westinghouse made a fixed-price bid on the project?

Mr. MORRIS. No, sir.

As far as the research and development is concerned, this will be on a cost-plus-fixed-fee arrangement.

Representative HOLIFIELD. So this is an estimate?

Mr. MORRIS. The amount shown is the ceiling for the Commission.

Representative HOLIFIELD. The research and development is a ceiling?

Mr. MORRIS. A maximum amount.

Representative HOLIFIELD. But the company itself is accepting a possible additional increment to their estimated costs?

Mr. MORRIS. The associates?

Representative HOLIFIELD. Yes.

Mr. MORRIS. As you note, the ceiling on the AEC research and development assistance is subject to escalation.

Representative HOLIFIELD. That is the $2,288,000 item?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. And if the cost of the reactor runs over the $29,228,000 of the association, that additional cost will be borne by them?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. Are there any questions by the other members?

Representative HOSMER. No questions.

Representative HOLIFIELD. Of the staff?

Mr. RAMEY. Is there an obligation to construct the reactor under the contract?

Mr. DAVIS. Yes.

Mr. MORRIS. There will be a contractual obligation subject to the termination rights as spelled out here, which are basically termination by mutual agreement, except that the associates may terminate if they are unable to obtain necessary license and regulatory approval or to obtain adequate liability insurance coverage. It is similar to the provision we have in the Northern States contract.

Mr. RAMEY. What is the nature of the postconstruction research and development work?

Mr. MORRIS. This will be experimentation. It is clearly understood between AEC and the companies that this will not be used in any way to reduce their operating costs.

Mr. DAVIS. It would be such things as taking apart the fuel elements and examining them, doing other kinds of things connected with actual research and development type operations that would not

normally be done in connection with simply the separate operation of the power reactor.

Representative HOLIFIELD. Is it your opinion, Mr. Davis, that this will represent a substantial step forward in technology?

Mr. DAVIS. I believe it will; yes, sir.

Representative HOLIFIELD. There is no plant of this particular type and size in existence today, is there?

Mr. DAVIS. No, there is not.

Representative HOLIFIELD. What is the closest to it?

Mr. DAVIS. I do not know of any that are close to it. The closest thing to it that is actually contemplated at the moment would be this Hanford plutonium recycle test reactor, which is of the same general type of design but intended for quite a different purpose.

Representative HOLIFIELD. There is a similar plant in Canada, I understand.

Mr. DAVIS. There are two test reactors in Canada, but they are of a substantially different design basically, and a different purpose.

Representative HOLIFIELD. Smaller?

Mr. DAVIS. No. The NRX is about 50 thermal megawatts, and the NRU is about 200, which is quite a bit bigger.

The Canadians are planning to build what they call a nuclear power demonstration reactor, which would be a reactor of, I guess, about the same size, although I do not know what their current designs are, which would be a tube-type heavy-water reactor as they now visualize it.

They originally started to construct it as a tank-type reactor and halted their construction and are now in the process of redesigining it.

Representative HOLIFIELD. Do you have access to their technology?

Mr. DAVIS. We have had very good access to their technology; yes, sir.

Representative HOLIFIELD. Will there be different techniques developed in this plant than they have developed in theirs?

Mr. DAVIS. There will certainly be some. They are trying very hard to utilize natural uranium. They do not contemplate the use of any enrichment. They are going toward all of the measures that they can to make the maximum use of natural uranium.

This reactor starts out with the concept that it is not attempting to get the cheapest nuclear power regardless of whether it can do it with natural uranium or not. So in this reactor they are attempting to do those things which are necessary to reduce the cost of nuclear power, and the enrichment may or may not come out, even in large plants, to be as low as natural uranium. My own guess would be the cheapest power would not be with natural uranium.

Representative HOLIFIELD. The Commission has approved this as being a substantial step forward, then, justifying the $14 million expenditure?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. I note that another Member of the House from South Carolina is here, Congressman Hemphill. Congressman Hemphill has talked with me about this matter a number of times and corresponded with me about it.

Would you care at this time to have something to say? We are just finishing the hearing on the Carolinas-Virginia Nuclear project.

STATEMENT OF HON. ROBERT W. HEMPHILL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF SOUTH CAROLINA

Representative HEMPHILL. Mr. Chairman, I want to say on behalf of these people and my district in which we hope to locate this plant, we appreciate the dispatch with which you held the hearings on it.

Rather than interrupt your busy schedule or impose on your responsibilities, I would just like to say we are awfully anxious to build this plant, and we hope it can be of service to the Nation and to the progress of atomic development.

Representative HOLIFIELD. I will say this: If your constituents are as anxious down there to build this as you have been, Congressman, the committee should certainly consider it seriously. We appreciate your interest in the matter and the committee will give it due consideration.

Representative HEMPHILL. Thank you so much.

Representative HOLIFIELD. You certainly are welcome.

Are there any other questions on this project?

Mr. MORRIS. I can now give you the percentage participation of the various companies.

Representative PRICE. Mr. Chairman, I would like to state Congressman Riley is equally interested in this matter. He has discussed it with me on numerous occasions.

Representative HOLIFIELD. He has been talking to you?

Representative PRICE. Yes.

Representative HOLIFIELD. I think all of these Congressmen down in the district where this interest lies have been unusually diligent in their contact with members of the committee. I will have to say that for the record.

All right, Mr. Morris, you may give those figures.

Mr. MORRIS. The participation of the companies that make up the CVNPA Associates is:

	Percent
Duke Power Co	34
Virginia Electric & Power Co	33½
Carolina Power & Light Co	20
South Carolina Electric and Gas Co	12½

Representative HOLIFIELD. Thank you, sir.

Let's take the next project, the Piqua project, in order to accommodate some of the people from that district who have early plane reservations.

Before we go to the Piqua project, are there any of the Carolinas-Virginia people or the Westinghouse or Webster people that have anything to add to the hearings this morning?

(No response.)

Representative HOLIFIELD. If you decide to file any additional evidence with the committee on this project, I suggest, then, that you file it in writing, if you have nothing to say at this time, and file that within the next few days.

Thank you for your attendance. Your attendance was not mandatory, it was invitational, and we did not know but what something might come up where you would want to testify.

Mr. W. B. McGUIRE (attorney for the CVNPA). We were here in the event it would be necessary and, as it developed, we do not feel there is any necessity.

Representative HOLIFIELD. Will you identify yourself?

Mr. McGUIRE. W. B. McGuire, attorney for the Carolinas-Virginia Nuclear Power Associates.

Representative HOLIFIELD. Will you give the names of your associates?

Mr. McGUIRE. Senator Thurmond did that in his statement.

Representative HOLIFIELD. Thank you.

Mr. Davis, will you please make the presentation on the Piqua matter?

(The program justification for the Piqua project follows:)

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58-111-7

A. Name of contractors

1. City of Piqua, Ohio, for operation of reactor.
2. North American Aviation, Inc., Atomics International Division, Canoga Park, Calif., for research, development, fabrication, construction, test, operation, and training.

B. Description of proposed project

1. *Objective.*—The objective of the proposed contract is to bring new resources into the development of engineering information on the performance of nuclear power reactors and to advance the time when nuclear power becomes economically feasible. An organic-moderated and cooled nuclear reactor fueled by slightly enriched uranium and designed to produce about 162,000 pounds of steam per hour and 12,500 electric kilowatts of energy will be constructed by AI under contract with AEC. The city of Piqua, under separate AEC contract, will provide the site and conventional facilities and will operate the entire plant for 5 years as part of its electric generating and industrial steam distribution facilities.
2. *Location.*—Piqua, Ohio.
3. *Technical aspects (data are approximate).*

Heat output: 45.5 megawatts.
Electrical output: 12.5 megawatts (nominal).
Amount of fuel: 6,250 kilograms.
Enrichment percent U–235: 1.8 percent.
Moderator: high boiling point hydrocarbon.
Coolant: high boiling point hydrocarbon.
Reactor outlet temperature: 600° F.
Reactor pressure: 120 pounds per square inch.
Steam conditions at steam generator outlet: 450 pounds per square inch at 550° F.
Byproduct production: undetermined.

4. *Estimated date of completion.*—July 1961.

C. Estimates of cost (in thousands):

Element of cost	Allocation of estimated costs	
	AEC	Piqua
1. Preconstruction research and development	$3,500	
2. Design, fabrication and construction:		
(a) Reactor:		
Engineering design and services	[1] 925	
Reactor plant construction and fabrication of fuel for 5 years' operation	[2] 5,100	
(b) Turbogenerating and related conventional facilities		$3,955
Subtotal	9,525	3,955
3. Operation:		
(a) Operator training	[3] 350	
(b) Other operating costs	[4] 930	
Subtotal	1,280	
4. Escalation:		
Reactor plant and fuel	1,431	
Operator training	69	
Subtotal	1,500	
5. Total value of AEC assistance	12,305	

[1] Subject to escalation, not to exceed 25 percent if upward.
[2] $4,800,000 represents Atomics International contract price, with the price including about $1,750,000 for 5 years' fuel and the contract providing for escalation, not to exceed 25 percent if upward. The additional $300,000 consists of $200,000 allowance to convert uranium hexafluoride to alloyed metal ingots, plus $100,000 allowance for containment and minor items not included in contract price.
[3] Includes $275,000 for training services furnished by AI subject to escalation not to exceed 25 percent if upward.
[4] After sale of steam to Piqua.

D. General features of proposed arrangements

1. *Direct contract with city of Piqua*—

(*a*) *Site.*—Under the contract, Piqua will furnish the reactor site near its existing steam plant on the Great Miami River. The Government's right to use the site for the purposes of this project will be assured by provision of a rent-free lease for 10 years, subject to yearly extension thereafter at AEC's option up to a maximum of 15 years.

(*b*) *Construction.*—Piqua will furnish the conventional turbine generator and industrial steam distribution facilities without cost to AEC. AEC will provide the reactor plant.

(*c*) *Operations.*—Piqua will operate the reactor for AEC for 5 years and will be reimbursed for its direct costs plus incremental general and administrative costs.

(*d*) *Sale of steam.*—The contract will provide for operation of the entire plant by Piqua and for the sale to Piqua of all steam produced by the reactor plant. The steam pricing methods to be applied as the work progresses are as follows:

(1) During the initial operating period, Piqua will pay:

(a) A price per 1,000 pounds of steam equal to the value of the conventional fuel that would have been required to produce in Piqua's composite conventional plant the number of kilowatt-hours of electrical energy that could be produced in Piqua's plant from 1,000 pounds of steam meeting the design specifications for steam to be produced in the reactor. Fuel value will be determined on the basis of the actual average cost of conventional fuel delivered to the Piqua powerplant in the month preceding the month in question; and

(b) Any demonstrable savings, in operations and maintenance costs on the conventional equipment attributable to reactor operation.

(c) On and after the date when the city first utilizes the reactor as a "firm power" component of its system, the foregoing price will be increased by adding appropriate fixed charges on the hypothetical conventional plant of comparable capacity replaced by the reactor.

(*e*) *Training.*—AEC will conduct, at the Government's expense, a program of training for up to 16 of Piqua's operating personnel.

(*f*) *Term.*—The term of the contract will run from the date of execution to the date 5 years after Piqua commences operation of the reactor plant.

(*g*) *Indemnity.*—AEC will indemnify Piqua against losses or damages arising out of nuclear incidents in a manner consistent with Public Law 256, 85th Congress.

(*h*) *Sale of the reactor plant.*—At the expiration or termination of the contract, the Government will, in accordance with law, offer to sell the reactor plant to Piqua pursuant to the provisions of Public Law 162, 85th Congress.

(*i*) *Termination.*—The contract will be subject to termination for the convenience of the Government. AEC will reimburse Piqua for its allowable costs and commitments incurred.

(*j*) *Patents.*—In case an invention or discovery is made by Piqua in connection with the work under the contract, AEC will receive all rights.

(*k*) *Licenses.*—The contract will be considered one with and for the account of AEC and no AEC licenses will be required.

(*l*) *Information and records.*—Piqua will maintain accounts showing all costs of operating the reactor and its conventional powerplant. Piqua also will provide AEC with full technical, economic, and financial information and reports and AEC and the Comptroller General will have the right to inspect the work, records, reports, information, data, and activities of Piqua under the project. AEC may use the information as it sees fit.

2. *Direct contract with Atomics International.*—

(*a*) *Research and development.*—Under a separate CPFF contract, AI is presently conducting research and development on organic moderated reactors of the Piqua type. The conceptual design for the Piqua reactor and component testing will be performed as additional work under this contract.

(*b*) *Engineering design, training, and test operation.*—When the research and development program has been completed and final design criteria for the Piqua reactor established, AI will perform all remaining engineering effort including the final design, and project engineering, the field engineering, personnel training, and a reactor operational testing program of not more than 71 man-months under the CPFF contract with a $1,200,000 ceiling on these costs. This cost ceiling is subject to escalation not to exceed 25 percent, if upward, based on the submission date of the original proposal (February–April 1956). Costs in excess of the ceiling will be borne by AI.

(*c*) *Fabrication and construction.*—AI will construct the reactor, and fabricate the fixed quantity of fuel which is estimated to be sufficient for at least 5 years of operation, for a total fixed price of $4,800,000. The price includes a reactor building of conventional type with controlled ventilation, although AI will absorb up to $50,000 for any changes (such as containment features) which may be required for reactor safety purposes. The contract will provide for escalation not to exceed 25 percent, if upward, based on the submission date of the original proposal. AI will use its best efforts to complete reactor construction and preoperational testing within 31 months after receiving notice to proceed with final design and construction.

(*d*) *Notice to proceed.*—Notice to proceed with final design and construction will be issued by the AEC after—

(1) the research and development program and OMRE operation have produced results which are determined to be successful according to criteria specified in the contract, and

(2) AEC has approved the final conceptual design of the reactor.

(*e*) *Warranty.*—AI will warrant—

(1) the reactor's capacity to achieve intial criticality.

(2) the performance of all reactor systems outside the core except the shielding, for a period of 1 year following reactor criticality, and

(3) the average performance of the fuel elements for 3,000 MWD/T.

(*f*) *Training.*—AI will conduct a training program for up to 16 of Piqua's personnel.

(*g*) *Title.*—Title to the entire reactor plant and the fuel elements will be in the Government.

(*h*) *Indemnification against nuclear hazards.*—AI will be indemnified by AEC in the same manner as other similarily situated AEC contractors in accordance with the provisions of Public Law 256, 85th Congress.

(*i*) *Termination.*—AI will have the right to terminate the fixed price contract if—

(1) the research and development program results or the results of OMRE operation are determined to be unsuccessful, according to criteria to be contained in the contract.

(2) AEC fails to issue notice to proceed within 60 days after completion of final conceptual design, or

(3) AI cannot obtain licenses or regulatory agency approvals necessary to complete the work.

AEC will have the right to terminate this contract at any time for the convenience of the Government.

Amounts to be paid AI upon termination will be determined in accordance with the standard termination article for a fixed-price Government supply contract, except that no profit will be allowed where termination is by AI.

(*j*) *Patents.*—The Government will own the entire right, title, and interest to any inventions or discoveries made in the performance of work under the contracts, subject to a nonexclusive, irrevocable, royalty-free license under any such invention or discovery to AI.

(*k*) *Licenses.*—The contract will be with AEC and it is expected that no AEC licenses will be required.

(*l*) *Information and records.*—AEC will own and have unlimited rights to use and disseminate copies of drawings and data produced under the contracts. AI will furnish such information and data to AEC for these purposes as AEC may reasonably require. AEC and its representatives will have the right to inspect and audit the work, records, reports, information, data, and activities of AI and its subcontractors under the project. The contract will also include the statutory GAO audit provision.

(*m*) *Priority.*—AI will agree to give this reactor project priority over any other organic moderated reactor power reactors it may build. Conversely, AEC will agree to assign AI a procurement priority on this project compatible with any other civilian power reactor program.

Mr. DAVIS. Yes, sir, Mr. Chairman.

STATEMENT OF W. K. DAVIS, DIRECTOR, DIVISION OF REACTOR DEVELOPMENT, ATOMIC ENERGY COMMISSION

Mr. DAVIS. The Piqua organic moderated and cooled reactor will be the first power reactor of what now appears to be a very promising reactor type. The primary reason for interest in this reactor concept is its potential for very low construction cost.

The construction cost for organic reactors should be low since the use of organics as coolant and moderator (1) allows production of reasonably high temperature steam with low reactor coolant pressure, (2) allows the use of ordinary inexpensive materials of construction, (3) provides a coolant which is chemically compatible with all materials in the reactor system, and (4) simplifies the maintenance problems because of the low activation of the coolant in the reactor.

The value of these advantages must be weighed against the cost of replacing the organic coolant which slowly decomposes at high temperatures and under exposure to radiation.

In 1955, an AEC program was initiated at Atomics International to develop organic reactors. An important part of this research and development was to study the rate of decomposition of organic coolants.

The organic moderated reactor experiment was built at the National Reactor Testing Station as an irradiation facility to study the behavior of the most promising organic compounds under conditions similar to those in power reactor applications.

In 1057, construction of the OMRE was completed and test operation started early in 1958. We now have our first data from the OMRE and the results are quite encouraging.

These preliminary data indicate that organic replacement costs in a power reactor designed to use organic moderators and coolants will amount to approximately 1 mill per kilowatt-hour of electricity produced.

As a part of our base program, we are investigating chemical inhibitors and other methods of reducing the cost of organic replacement.

We are considering combinations of organic coolants with other moderators as a means of reducing the amount of organic exposed to radiation in the reactor and reducing the organic replacement cost.

In response to our second round invitation, the city of Piqua submitted a proposal for the 12.5 megawatt organic moderated and cooled reactor which we are discussing today.

The price which we have negotiated with North American Aviation, Inc., for this reactor plus the standard allowances for a new turbogenerator and the estimated first core cost amounts to slightly less than $500 per kilowatt. This is appreciably lower than actual or estimated capital cost of any known nuclear powerplant of comparable size and is lower than the cost of a number of other reactor types of larger size.

The favorable cost for this reactor, even though it is the first of its type to be built, bears out our original belief that the use of organic coolants and moderators would result in low capital costs.

The principal provisions of the proposed contractual arrangements, including the undertakings and financial commitments of the parties, are set forth in the program justification data sheet. As indicated there, the total estimated cost to AEC for development, construction and 5 years of operation is $12,305,000.

Representative HOLIFIELD. Mr. Durham.

Chairman DURHAM. Doctor, you speak of the significance of the 50 percent increase in primary system pressure enclosed in this thermodynamic cycle.

Has that already been proven by research?

Mr. DAVIS. Increase the steam pressure?

Chairman DURHAM. Yes.

Mr. DAVIS. The organic moderated experiment at Idaho has shown that the organic material can be operated at temperatures which will allow the production of steam at very substantially higher pressures.

Chairman DURHAM. In what range of pressures?

Mr. DAVIS. The reactor has been operating, I believe, at the present time, up to temperatures of a little over 700° organic outlet. This would allow you to produce steam probably as high as 600° to 650° F., depending here on the relative economics of larger versus smaller heat exchangers, versus added efficiency of high temperature steam.

Representative HOLIFIELD. How does it compare to the Shippingport range?

Mr. DAVIS. The outlet, I believe, is 550° F.

Representative HOLIFIELD. I had in mind about 540.

Chairman DURHAM. That is why I asked the question, if this is actually a fact, it is quite a breakthrough.

Mr. DAVIS. It is actually a fact that organic material will operate at these temperatures.

Chairman DURHAM. You know the organic material will operate at these temperatures?

Mr. DAVIS. Yes, sir. There is still a lot of research and development going on to determine what the effect of radiation and temperature is on the breakdown rate of the organic.

So far, however, it has fallen very close to what the estimates on in-pile loops show.

We believe we now have quite good confirmation that our predictions for this are on pretty sound ground.

Mr. HOLIFIELD. Do you have corrosion or erosion problems on the organic fuel?

Mr. DAVIS. With the organic material you have virtually no corrosion problems. Since you have no solids suspended, there are no erosion problems even with normal of construction.

Furthermore, the organic material does not become activated by the exposure in the reactor and it has been found that the amount of radiation even in the organic material coming directly out of the reactor is such that it is low enough so that you could actually be right by the outlet pipes without any appreciable amount of shielding.

Representative HOLIFIELD. From what you tell me, this would not be considered a high risk type of reactor from a radiation standpoint?

Mr. DAVIS. This appears to be a reactor involving a minimum of radiation problems.

Representative HOLIFIELD. This would be reviewed by the Reactor Safeguards Committee, notwithstanding the fact that the people do not have to have a license?

Mr. DAVIS. It certainly would be reviewed by the reactor hazards people in the Commission and presumably by the committee.

Chairman DURHAM. In other words, you pass on this just like you would any other reactor as far as safety?

Mr. DAVIS. We would certainly give it the full safety treatment; yes, sir.

Representative HOLIFIELD. Do you believe July 1961 is a realistic completion date for this reactor?

Mr. DAVIS. Yes, sir; I believe it is. One thing that you should bear in mind in looking at the schedules, is that very large reactors take about a year longer to build than the smaller ones.

When we are talking about reactors of this size range, you can cut a year off the time for a much larger one.

Representative HOLIFIELD. If this is passed by Congress when will construction start on this project?

Mr. MORRIS. The research and development that will precede the final design period should be completed late this fall.

At that time they will start the final design and I believe begin actual fabrication and construction next spring.

Representative HOLIFIELD. You would have about 2½ years construction schedule?

Mr. MORRIS. Yes.

Representative HOLIFIELD. I notice that you have estimated that your cost of fuel for 5 years will be $1,750,000. This is not necessarily a ceiling cost, is it?

Mr. MORRIS. Yes, Mr. Holifield, $1,750,000 is not a very firm figure in that it is included in a fixed price we have from North America Aviation Atomics International Division for the fabrication and construction of the reactor, including fuel.

Representative HOLIFIELD. Is that included in the $3,500,000?

Mr. MORRIS. No, it is included in the $5,100,000 shown opposite item C 2–A.

Representative HOLIFIELD. Are they responsible for the fabrication of the fuel, also?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. For their own reactor?

Mr. MORRIS. Yes.

Representative HOLIFIELD. You have required from them a life of 5 years for this amount?

Mr. MORRIS. That is part of the arrangement between AEC and North American, not the life of the individual fuel elements.

Representative HOLIFIELD. Total overall cost. Is that the burnup? That must be the burnup.

Mr. MORRIS. Yes.

I might explain that the arrangement involves three different arrangements really on cost. The $3,500,000 for preconstruction research and development will be done on a cost-plus-fixed-fee basis, without a ceiling.

The design work and the training of reactor operators will be done on a cost basis with a ceiling. The fabrication and construction, namely, $5,100,000, is a fixed price.

Representative HOLIFIELD. But your $925,000 is subject to a 25 percent upward escalation clause.

Mr. MORRIS. Yes.

Representative HOLIFIELD. Over that the company would have to bear it?

Mr. MORRIS. Right.

Representative HOLIFIELD. The plant construction also has a 25 percent upward escalation cost?

Mr. MORRIS. Yes.

Representative HOLIFIELD. Why is it that in this case you show the $1,750,000 as construction cost rather than as operating cost?

Mr. MORRIS. It is only because it is included in a fixed price construction contract.

Representative HOLIFIELD. And it is Government owned?

Mr. DAVIS. Actually, the way it is stated, reactor plant construction and fabrication of fuel for 5 years of operation. Probably in trying to assess economics you would treat it as an operating cost.

Representative HOLIFIELD. But the reason it would not be in the other side is because the Government has the ownership of this plant?

Mr. DAVIS. That is right.

Representative HOLIFIELD. And, therefore, it becomes their liability.

What does Piqua expect to pay per kilowatt on this? They are just buying steam for the generator, are they not?

Mr. MORRIS. Yes, sir; they are going to operate the reactor and be reimbursed for operating the reactor and they will purchase all steam produced from the reactor in accordance with a steam pricing formula which is described here in the program justification data sheet.

Representative HOLIFIELD. Will it approximate the 2.88 mills they were able to pay when they were before us last year?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. They are pretty good bargainers, these fellows down at Piqua. They have done a better job than DuQuesne.

Mr. MORRIS. We have not found any that are not good bargainers, Mr. Holifield. They are all good negotiators.

The steam pricing arrangement described here basically provides that during the initial period prior to the time the reactor has demonstrated its dependability and prior to the time their load requires this additional capacity as a firm source, they will be paying us for steam the amount they would have spent for fuel to produce the same steam in a conventional boiler plus any identifiable operation and maintenance cost.

Representative HOLIFIELD. In their computation of cost did they include the capital investment?

Mr. MORRIS. That factor would be added to the steam price at the time when they would use this reactor as a firm power component of their system, that is after the reactor has shown its dependability and they do not have to back it up with other capacity.

The fixed charge element would go into the steam price at that point.

Representative HOLIFIELD. Otherwise the amount they are paying only represents fuel cost.

Mr. MORRIS. Plus any identifiable operation and maintenance savings by not having to operate this backup boiler. But then when they no longer need the backup boiler capacity because the reactor has shown its dependability and their load requires this as a firm power source, then the measure of the steam price would be the full cost of comparable conventional steam, including fixed charge element.

Representative HOLIFIELD. Piqua is supposed to put in $3,955,000 turbo generating and related conventional facilities, I see, according to the list here.

Mr. MORRIS. Piqua is making available turbo generator facilities which are existing facilities and they have put a value of $3,955,000 on these facilities that will be used in conjunction with the nuclear plant.

Actually in the Piqua case they have several units in one plant that are all interconnected. It is rather difficult to say which turbine will receive this steam since they are interconnected with the header.

Representative HOLIFIELD. Is this an unused turbo generating facility that they have at the present time?

Mr. MORRIS. No. During the initial period the turbo generator receiving the steam from the reactor would receive it in lieu of steam from the existing boiler.

In other words, an existing boiler would be shut down to the extent that the reactor could be operated. That is during the initial period I spoke of earlier.

Representative HOLIFIELD. Has there been any attempt to determine whether this is a fair appraisal or is this an inflated appraisal to make these good bargainers down there look good on paper?

Mr. MORRIS. We have not questioned the value put on these existing facilities since under our proposed contract arrangement it has very little significance in that they are obligated to provide adequate turbo generator facilities to receive the steam regardless of what value they have.

Representative HOLIFIELD. Does this seem to be a reasonable amount for the value of the turbogenerating facilities that they are furnishing?

Mr. MORRIS. I think clearly one could build a turbo generator of this size for less than that. Some of the Piqua representatives are here and might be able to explain that.

Representative HOLIFIELD. Who is here representing Piqua at this time? Is it the same capable gentleman that was before us last year?

Mr. MORRIS. It is.

Representative HOLIFIELD. Mr. Gallagher.

STATEMENT OF JOHN GALLAGHER, OF THE CITY OF PIQUA, OHIO

Mr. GALLAGHER. Congressman, we have facilities of 33,000 kilowatts of capacity and as we project our load, if this reactor produces more power, as some reactors have already produced more power than their nameplate rating, we would be in a position to utilize that power and to determine the actual maximum capacity of the particular reactor vessel.

What I heard down here the last time I was down about the boiling water reactor at Argonne having quite a bit of excess capacity and that was vented to the atmosphere because the turbogenerator had a limited capacity.

The value that we have listed is the depreciated value on our equipment in our existing plant which would perform two functions, steam standby for the reactor and turbogenerator capacity not to equal the nameplate rating of a reactor, but the nameplate rating of our equipment, and consequently, if the reactor did put out 2,000, 5,000, or 10,000 more kilowatts of capacity, we would be in a position to utilize that to the advantage of AEC and ourselves.

Representative HOLIFIELD. The price, then, of $3,955,000 refers to your total generating capacity which is capable of taking 33,000 kilowatts?

Mr. MORRIS. That is correct.

Representative HOLIFIELD. Is this reactor supposed to produce about 12,500 kilowatts and we divide that by 3 if we want to be realistic?

Mr. MORRIS. That is right. It is a very arbitrary figure. It depends on what you are trying to shoot at.

Representative HOLIFIELD. I realize all these arrangements are 1 horse and 1 rabbit. I just want to see how big the rabbit is.

Are there any further questions?

Representative HOSMER. Mr. Chairman, the gentleman from Ohio, our colleague, Mr. McCulloch, was not able to get here this morning, and he has asked me to express to the committee—I think the way he put it is self-evident—Piqua are sharp bargainers. But he also wanted

to assure us they are very able to administer their power system there and he, personally, would be delighted if this contract is approved.

Representative HOLIFIELD. I might say for the record that Congressman McCulloch has contacted me on this matter and has shown his interest in it over the period of time it has been in negotiation.

I am sure if these gentlemen are as good at operating a plant as they are at bargaining, that this will be a very efficient operation.

Mr. TOLL. Mr. Morris, is this a guarantee for 5 years as to the fuel that North American will provide, or is it that they will provide a certain amount of fuel and it is estimated that will last for 5 years?

It is a fixed price contract, but exactly what is being furnished, a guarantee of operation or a fixed quantity of fuel?

Mr. MORRIS. It is essentially the amount of fuel that will be required to get an average burnup of 3,000 megawatt-days per ton.

Mr. TOLL. If it only last 3 years——

Mr. MORRIS. In other words, they are furnishing an amount of fuel for this price which is predicated on the estimated burnup of at least 3,000 megawatt-days per ton. To the extent that burnup is not achieved, they will supply more fuel within this price.

Mr. TOLL. It says here they will fabricate a fixed quantity of fuel which is estimated to be sufficient for at least 5 years. Does that mean they might fabricate more fuel?

Mr. MORRIS. If they don't achieve the burnup that they are assuming.

Representative HOLIFIELD. At the beginning of these negotiations I believe the Piqua plant was supposed to sell their steam for processing. Has that been changed now to the electric generating or am I in error?

Mr. MORRIS. From this plant which has, I think, 4 or 5 interconnected units they do sell some industrial steam. A portion of this steam may be sold as industrial steam.

Mr. Toll, on page 6 of the program justification data sheet under the heading "Warranty," it is indicated that the manufacturer is warranteeing the actual performance of the fuel element of 3,000 megawatt-days per ton.

Mr. TOLL. Listed under the item of training there is $350,000, and it says that of this $275,000 will be for training services furnished by North America.

What is the other $75,000?

Mr. MORRIS. The salaries of the people who are being trained, who will be on the city of Piqua payroll.

Mr. TOLL. The AEC will pay those salaries?

Mr. MORRIS. Yes.

Representative HOLIFIELD. AEC will also carry the indemnity on this?

Mr. MORRIS. Yes.

Mr. TOLL. Will the city of Piqua contribute anything to the training of these people?

Mr. MORRIS. The answer is essentially no on a nonreimbursable basis.

Mr. RAMEY. Does the city of Piqua pay any overhead on your reimbursement for the training?

Mr. MORRIS. We would reimburse for overhead only to the extent that it can be demonstrated that incremental additional overhead is shown to be necessary by reason of this operation.

We are reimbursing the normal payroll burden on the operators and that sort of thing.

Chairman DURHAM. Is that a fixed cost for a 5-year period?

Mr. MORRIS. No, sir; we are going to reimburse the city for the actual costs incurred in operating this nuclear plant, less the amount of the steam credits we get.

Chairman DURHAM. I might say, Senator Bricker has expressed his interest in this project several times before the committee. He is not here this morning, but he is interested in it.

Representative HOLIFIELD. I see that there is also research and development with Atomics International going on under a cost-plus-fixed-fee contract on a organic moderated reactor of the Piqua type.

Of course, none of those costs are included in this. The costs that are included in this are for the conceptual design and component testing will be performed as additional work under the contract.

Mr. DAVIS. Yes, sir; under this contract.

Representative HOLIFIELD. I also note that you have claimed all patent rights under this for the Government, as you should, where all the money is put up.

Mr. DAVIS. We will incidentally be carrying on a development program on the application of this type of reactor quite broadly, aside from the specific one on this project.

Repesentative HOLIFIELD. Excuse me; I did not hear that.

Mr. DAVIS. We will also be carrying on a development program on organic moderated reactors for a variety of applications in addition to this specific work covered by this contract.

Representative HOLIFIELD. When will work on this start?

Mr. DAVIS. This is one of the questions here and was the reason that we requested the waiver. North American now has people available who can start doing this work and we are ready to start work under this contract just as soon as it can be arranged.

Representative HOLIFIELD. Is it your intention, then, to issue notice to proceed as soon as you have the proper authority?

Mr. DAVIS. As soon as we have the proper authority, and the contractual details settled.

Representative HOLIFIELD. No AEC licenses will be required on this because it will be Government owned?

Mr. DAVIS. It will be Government owned and will not require license, but will follow many of the same procedures.

Representative HOLIFIELD. I notice here that you say you will give the reactor project priority over any other organic moderated power reactors that you might build.

Mr. FIELDS. That is North American.

Representative HOLIFIELD. Oh, this is North American's agreement?

Mr. FIELDS. Yes, sir.

Representative HOLIFIELD. This protects the priority on this in case they have other contracts in this same field?

Mr. DAVIS. We are very hopeful of their being able to sell some larger reactors of this sort, and I think it is important that if we do go ahead on this one that we have some assurance of the priority.

Representative HOLIFIELD. Is there any statement that the city of Piqua people, or the North American Aviation, Inc., Atomics International division wish to make at this time?

STATEMENT OF ROBERT HANCE, CITY MANAGER OF PIQUA, OHIO

Mr. HANCE. My name is Robert Hance. I am the city manager of Piqua.

I would like to say generally that our city government and our people are very proud and happy to have a small part in this program. We hope it will be a real asset.

Representative HOLIFIELD. Thank you, sir.

Are there any further questions?

If not, we will proceed to the next item.

Mr. Davis, you may proceed on Elk River.

Mr. DAVIS. The reactor proposed for the Rural Cooperative Power Association is a closed-cycle boiling water reactor, moderated and cooled by light water, and fueled by a mixture of uranium oxide and thorium oxide.

A separate, conventionally fueled superheater is provided to bring the steam conditions to the RCPA turbine requirements. The reactor and superheater will be capable of delivering 225,000 pounds per hour of nonradioactive steam at the required conditions of temperature and pressure. The net electrical output of this plant is 22,000 kilowatts.

The design of this reactor is based, to a large extent, upon the design and operating experience of the EBWR and BORAX plants, but it also incorporated technological improvements which are expected to improve the economic stature of this plant.

Of significance is the 50 percent increase in primary system pressure and the use of the closed thermodynamic cycle, the first application of this cycle to boiling water reactors. Both of these features are expected to improve reactor stability and simplify plant control.

Since December 1956, the BORAX IV reactor has been operating with a urania-thoria fuel loading. This fuel has demonstrated high corrosion resistance, irradiation stability, and satisfactory thermal properties.

Preliminary results of investigations now in progress at the Argonne National Laboratory indicate that this fuel, when combined in the proper proportions, is capable of achieving high conversion ratios, resulting in longer reactivity lifetimes and substantially reduced fuel costs.

The ultimate goal of this fuel cycle is a system which is capable of operating independent of a source of enriched material, that is, breeding. This application is a step in that direction in that it will supply information of value to the overall understanding of the cycle.

The reactor, as proposed, is a logical extension to our overall boiling water reactor program and justifies our support.

In the section on operation on the RCPA program justification data, we have a general understanding with RCPA that RCPA is obligated to utilize reactor steam to the fullest extent possible consistent with sound utilities practices.

In his decision of May 7, 1958, which we forwarded to you on May 16, 1958, covering the propriety of the proposed arrangements for the sale of steam, the Comptroller General stated his belief that the conditions under which RCPA may be excused from utilizing such steam should be described in greater detail.

Accordingly, we have discussed and reached an agreement in principle with RCPA on more definitive provisions to cover this point.

Under our agreement, RCPA would not be obligated to operate the reactor under the following conditions:

First, if RCPA cannot use the steam from the reactor due to outage or shutdown of its associated turbo generators or transmission facilities, or to other cause beyond RCPA's control.

Second, if prior to the time the reactor is proved to be reliable, a portion of RCPA's conventional generating facilities are shut down and a reactor scram would demonstrably cause interruption of service to RCPA's firm power customers. Definitive provisions amplifying this agreement will be included in the definitive contract.

The principal provisions of the proposed contractual arrangements, including the undertakings and financial commitments of the parties, are set forth in the program justification data sheet.

As indicated there, the total estimated cost to AEC for development, construction, and 5 years of operation is $11,445,000.

(The justification data referred to follows:)

PROGRAM JUSTIFICATION DATA—ARRANGEMENT NO. 58-111-8

A. Name of contractors

1. Rural Cooperative Power Association, Elk River, Minn., for operation of reactor.

2. ACF Industries, Inc., Nuclear Products-Erco division, Washington, D. C., for research, development, fabrication, construction, test operation, and training.

B. Description of proposed project

1. *Objective.*—The objective of the proposed project is to bring new resources into the development of engineering information on the performance of nuclear power reactors and to advance the time when nuclear power becomes economicaly feasible. A closed-cycle boiling water power reactor and superheater designed to produce 225,000 pounds of steam per hour and 22,000 electric kilowatts will be constructed by ACF under contract with the Commission. RCPA, under separate contract with the Commission, will provide the site and turbogenerator facilities and will operate the entire plant for 5 years as part of its system.

2. *Location.*—Elk River, Minn.

3. *Technical aspects* (data are approximate):

Heat output: 58.2 megawatts (excludes superheater, 14.8 megawatts).
Electrical output: 22 megawatts (nominal).
Fuel: Thoria-urania; 4219 kilograms ThO_2, 180 kilograms UO_2.
Cladding: Stainless steel or zirconium (costs and warranties referred to below are based on stainless steel).
Enrichment: U-235, fully enriched.
Moderator: H_2O.
Coolant: H_2O.
Reactor outlet temperature: 531° F.
Reactor pressure: 890 pounds per square inch.
Steam conditions at turbine: 600 pounds per square inch at 825° F.
By product production: None presently contemplated.

4. *Estimated date of completion.*—October 1960.

C. Estimates of cost (in thousands):

Element of cost	Allocation of estimated costs	
	RCPA	AEC
1. Preconstruction research and development		[1] [2] $321
2. Development, fabrication, and construction:		
(a) Reactor:		
Reactor plant (including superheater)		[1] 8,084
Fuel for first core (including 15 percent spares)		[1] 864
(b) Turbogenerator facilities	[3] $1,750	
Subtotal, item 2	1,750	8,948
3. Operation: [4] Estimated cost to AEC		[5] 2,176
4. Total value of AEC assistance		11,445

[1] These amounts taken together constitute a maximum. They include prorate allocations of fee and contingency.
[2] Includes costs of irradiations in AEC facilities.
[3] Excludes conventional boiler which will provide backup power until reactor proves dependable.
[4] Includes reimbursable costs of RCPA training, services, and other work.
[5] After sale of steam to RCPA. This estimate covers the entire 5-year operating period.

D. General features of proposed arrangements

1. Direct contract with RCPA.—

(*a*) Site: Under the contract, RCPA will furnish the reactor site, which will be adjacent to RCPA's existing steam plant at Elk River, Minn.

The contract will provide the Government an option to lease the site for up to 30 years on a rent-free basis following expiration of the contract term.

(*b*) Construction: RCPA will furnish the turbogenerator facilities without cost to AEC. AEC will provide the reactor plant, including the superheater.

(*c*) Operations: The contract will provide for operation by RCPA of the entire plant to the fullest extent and with the least interruption possible consistent with sound utilities practice as part of the RCPA system for 5 years and for the sale to RCPA of all steam produced by the reactor plant. The contract will also provide for certain supervision, inspection, test operation, and other services to be performed by RCPA prior to the 5-year operating period.

(*d*) Sale of steam and reimbursement: The intention of the parties is that the cost to RCPA be no more and no less by reason of the reactor plant than if the reactor plant were a conventional steam-generating plant, in accordance with the following:

(1) Sale of steam: The basic objective is to provide that the contractor will purchase the steam produced by the reactor plant at rates based upon the cost of comparable steam from a plant of the same size, using conventional fuels at the same location.

In achieving this objective, the contractor will be charged an amount equal to the value of conventional fuel which would be required to produce an equal amount of comparable steam from RCPA's new boiler plus any identifiable savings in operation and maintenance cost of said boiler resulting from operation of the reactor plant.

If at the time an additional turbogenerator is needed, the reactor has proven to be dependable so that no conventional boiler will be needed for the new turbine, RCPA's steam price will be increased to include:

(a) Fuel value as given above.

(b) Savings in operating and maintenance cost equal to the full cost of operating and maintaining the hypothetical conventional boiler of comparable capacity, displaced by the reactor.

(c) An amount equal to the fixed charges of the hypothetical boiler.

(2) Reimbursement: The contractor will be reimbursed for its allowable costs and expenses for the operation and maintenance of the reactor plant and for related services.

It is understood that general and administrative expenses will not be reimbursable except to the extent that the total of such expenses of an allowable nature incurred by the contractor is demonstrated to be increased beyond those that would have been incurred if the reactor plant were a conventional steam-generating plant.

It is further understood that certain special costs (to be defined and illustrated) necessary and incident to operating the contractor's conventional electric facilities and required solely because of the nuclear character of the entire project and operation, and not otherwise reimbursed or compensated, will be reimbursable to the extent that they are demonstrated to be costs that would not have been incurred if the reactor plant were a conventional steam-generating plant.

(*e*) Training: AEC will conduct, at the Government's expense, a program of training for up to 12 qualified employees of RCPA.

(*f*) Term: The term of the contract will commence on the date of execution and will end 5 years after the acceptance of the reactor plant by AEC as being completed, tested, and operable.

(*g*) Indemnity: AEC will indemnify RCPA against losses or damages arising out of nuclear incidents in a manner consistent with Public Law 256, 85th Congress.

(*h*) Sale of the reactor plant: At the expiration or termination of the contract, the Government will, in accordance with law, offer to sell the reactor plant to RCPA pursuant to the provisions of Public Law 162, 85th Congress. The contract will provide that, if such offer is not accepted, AEC will have an option to lease the site of the reactor plant.

(*i*) Termination: The contract will be subject to termination at any time by written agreement of the parties. Any such termination will be effective in the manner, upon the terms, and on the date specified in said agreement.

The Commission will have the right to terminate the contract (1) if it determines that the construction or operation of the reactor cannot be undertaken or continued without undue risk to the health or safety of the public (and the parties have not agreed to mutual termination), or (2) if, after the Commission has paid to the contractor, for operating costs, the sum of $3,040,000, less the costs incurred by the Commission for fabrication of the initial core loading (including spares), termination is desired for the convenience of the Government. In the event of termination by the Commission, the Commission will pay to the contractor, as full termination costs, the costs for which the contractor is then entitled to reimbursement. The Commission has no present intention to exercise the right to terminate for convenience unless it finds that the economic and technical promise of the reactor for commercial utilization by RCPA or others is unfavorable.

(*j*) Patents: In case an invention or discovery is made by RCPA in connection with the work under the contract, AEC will receive all rights.

(*k*) Licenses: The contract will be considered one with and for the account of the Commission, and no AEC licenses will be required.

(*l*) In formation and records: RCPA will maintain accounts showing all costs of operating its system. RCPA will also provide the Commission with full technical, economic, and financial information and reports, and the Commission and the Comptroller General will have the right to inspect the work, records, reports, information, data, and activities of RCPA under the project. AEC may use the information as it sees fit.

(*m*) Approval by Rural Electrification Administration: RCPA has outlined, informally, to the Rural Electrification Administration the understandings contained above, and has been advised that an agreement along these lines, as REA understands them, would not impair the feasibility of RCPA's REA loan and would be satisfactory subject to review of the final draft of the contract.

2. *Direct contract with ACF.*—

(*a*) Construction and test operation: ACF will develop, design, fabricate, and construct the reactor plant (reactor and superheater), train RCPA personnel, and perform a nuclear test program within 36 months of contract execution. The work will be performed under a cost-type contract with a ceiling price of $9,269,000, including fixed fee. The contract will provide AEC the option to purchase a second core, including 15 percent spares, under an arrangement providing a cost ceiling of $739,000, subject to escalation, plus fixed fee.

(*b*) Warranty: ACF will warrant—

(1) 28 days' continuous reactor operation at design power, exclusive of interruptions due to conditions beyond ACF's reasonable control, and

(2) Fuel-element performance to a maximum 6,700 megawatt-days per ton burnup at any 1 point in each element, with the warranty providing for sharing of replacement costs on a battery-type basis.

(3) Materials and workmanship.

(*c*) Training: ACF will conduct a program of training for up to 12 of RCPA's operators.

(*d*) Title: Title to the entire reactor plant, fuel elements, and superheater will be in the Government.

(*e*) Indemnification against nuclear hazards: ACF will be indemnified by AEC in accordance with the provisions of Public Law 256, 85th Congress.

(*f*) Termination: AEC may terminate, for convenience of the Government or for default of ACF, by paying ACF's reimbursable costs and commitments and reasonable termination costs. The fixed fee would be equitably adjusted. Under default termination, AEC may complete the work; ACF will be liable for costs caused by the default and will receive no further payments on acount of the fixed fee for work performed thereafter.

(*g*) Patents: Title to all inventions made or conceived in connection with ACF's portion of the project will become the property of the Government, with a nonexclusive, irrevocable, royalty-free license to ACF for outfield purposes only. ACF's proprietary information prior to the contract will be licensed to AEC without cost for purposes of the project.

(*h*) Licenses: This contract will be with the AEC and it is expected that no AEC licenses will be required.

(*i*) Information and records: ACF will keep, and require its subcontractors to keep, records of technical, economic, and financial data developed in connection with the project, and supply that information to the Commission for its use and dissemination. The Commission and its representatives will have the right to inspect and audit the work, records, reports, information, data, and activities of ACF and its subcontractors under the project. The contract will also include the statutory GAO audit provision.

(Subsequently, the following letter was also received:)

ATOMIC ENERGY COMMISSION,
Washington, D. C., May 9, 1958.

Mr. JAMES T. RAMEY,
Executive Director, Joint Committee on Atomic Energy,
Congress of the United States.

DEAR MR. RAMEY: This is in response to your telephone call of May 9, 1958, and will confirm your later conversation on that same date with Mr. Berman.

You asked about the status of an extension of the ACF Industries, Inc., deadline of May 15 on the ceiling-price proposal for the Elk River Reactor. During the course of contract negotiations on May 8, ACF's principal negotiator assured us that the company would provide us with a written 15-day extension of that deadline by May 12, 1958.

I trust that this will provide you with the information you desired.

Sincerely yours,

ALFONSO TAMMARO,
Acting General Manager.

Representative HOLIFIELD. At this point, without objection, we will insert in the record the letter to Mr. Strauss from the Comptroller General, dated May 7, 1958, on this matter of adjustment referred to in your statement.

(The letter referred to follows:)

COMPTROLLER GENERAL OF THE UNITED STATES,
Washington, May 7, 1958.

Hon. LEWIS L. STRAUSS,
Chairman, United States Atomic Energy Commission.

DEAR MR. STRAUSS: Reference is made to the General Manager's letter of April 29, 1958, requesting our advice as to whether the sale of steam under the second round of the Commission's power reactor demonstration program on the basis set forth in his letter is in conformity with the requirements of section 111 (a) (1) of Public Law 85-162 (71 Stat. 403).

Section 111 (a) (1) of Public Law 85-162 provides as follows:

"SEC. 111. COOPERATIVE POWER REACTOR DEMONSTRATION PROGRAM.—(a) There is hereby authorized to be appropriated to the Atomic Energy Commission, in accordance with the provisions of section 261 a. (2) of the Atomic Energy Act of 1954, as amended, the sum of $129,915,000 for use in a program not to exceed $149,915,000, subject to the following conditions:

"(1) Arrangements for projects sponsored under the Second Round of the Commission's power reactor demonstration programs by cooperatives and publicly

owned agencies under which the reactor is financed in major part by the Commission and is to be owned by the Federal Government, shall be carried on by direct contract between the Commission and the equipment manufacturer or engineering organization with respect to the development, design, and construction of the reactor and related facilities, and by direct contract between the Commission and the cooperative or publicly owned organization with respect to the provision of a site and conventional turbogenerating facilities, the operation of the entire plant including training of personnel, the sale by the Commission of steam from the reactor complex to the cooperative or publicly owned organization, and other relevant matters. Sale of steam by the Commission under contract with the cooperative or publicly owned organization shall be at rates based upon the present cost of, or the projected cost of, comparable steam from a plant using conventional fuels at such locations. Projects covered under this subsection shall be operated under contract with the Commission for such period of time as the Commission determines to be advisable for research and development purposes but in no event to exceed ten years. Upon the expiration of such period the Commission shall offer the reactor and its appurtenances for sale to the cooperative or publicly owned agency at a price to reflect appropriate depreciation but not to include construction costs assignable to research and development. In the event the cooperative or publicly owned agency elects not to purchase the reactor and its appurtenances, the Commission shall dismantle them."

In its report on the bill, the Joint Committee on Atomic Energy had this to say with respect to the meaning of the language concerning the sale of reactor steam:

"Steam would be sold to the cooperative or public organizations at rates based upon the present cost of, or the projected cost of, comparable steam from plants using conventional fuels at such general locations. By 'comparable' steam is meant steam of the same regularity and reliability, and of the same temperature and pressure as that obtained from conventional sources. By 'cost' is meant cost to the cooperative; that is to say, the ascertained value or charge for steam which the cooperative pays or would pay for steam of a comparable degree of interruptibility.

"The above are only general principles which, of course, will require adaptation to the circumstances of each contractual situation" (S. Rept. 791, p. 19; H. Rept. 978, p. 19).

A nuclear reactor cannot, at present, be considered a reliable or firm source of steam during the early period of its operation. Consequently, such steam cannot be relied upon by a generating company for production of power to supply its firm load demand. To the extent such interruptible steam is used to supply a demand for firm power, the company must have an alternate and reliable source of steam. In other words, interruptible steam produces only interruptible power, and its value depends on the value of such power. The larger a power company's system and load is, the more flexibility it has in the use of interruptible power. Conversely, the smaller the company's load, the more difficult it is to make use of interruptible power.

The price charged a purchaser of any product ordinarily is greater than the seller's cost of production. It might thus be argued that participants in the second round should pay rates for reactor steam somewhat higher than the cost of producing such steam in a conventional plant. On the other hand, organizations engaged in the generation of electric power from steam include steam boilers as an integral part of their generating facilities, and it is therefore obvious that, if a power company has boiler capacity to produce steam to generate sufficient power to meet its firm load demand, there would be no sound economic basis for it to pay more for purchased steam to meet that load than its own cost of steam production.

The Commission's power reactor demonstration program is an experimental program. The concept adopted by the Commission in the three rounds announced to date has been one of partnership between the Commission and the participants in the construction and operation of reactors in order to learn more about the technical and economic feasibility of nuclear power. This concept implies participation by nongovernmental organizations in what is essentially research and development work. By reason of their usual small size and limited capital it is at least questionable whether rural electric cooperatives and most publicly owned electric utilities are in a position to commit themselves to any financial risks to engage in research of this nature. This appears to have been one reason for the enactment of section 111 (a) (1) of Public Law 85-162,

which provides for complete Government financing of reactor construction under the second round. It was brought out in the hearings on that law that the Rural Electrification Administration, upon which most rural cooperatives must depend for capital loans, would not approve loans to enable cooperatives to participate in demonstration projects without assurance, in effect, that the power to be generated would cost the cooperative no more than power generated by conventional sources. Congressional approval of projects under the second round, subject to the conditions specified in section 111 (a) (1), must be assumed to have been given with knowledge of this fact, and we believe this is significant in construing those conditions.

The two proposed arrangements as to which our opinion is specifically requested are those between the Commission and the Rural Cooperative Power Association of Elk River, Minn., and the city of Piqua, Ohio. Both arrangements propose to charge for interruptible reactor steam a flexible price which amounts essentially to the cost saved by RCPA and Piqua by reason of not having to generate such steam in their own plants. In other words, it is contemplated by the arrangements that the cost to the utility of power generated from reactor steam would be no less or no more than that of power generated from steam produced in the participants' own plants. In both cases, because their need for firm power includes the power expected to be generated from reactor steam, the participants have conventional sources of steam which can be used when reactor steam is not available. The fixed charges on these conventional steam boilers must continue to be borne by RCPA and the city of Piqua, whether reactor steam is available or not. Consequently, the charges proposed to be made for reactor steam do not include any factor for such fixed costs which would normally enter into the production cost of, and the usual charge for, steam produced from conventional fuels. The arrangements do provide, however, for inclusion of such a factor in the charge for reactor steam, from the time when RCPA or the city of Piqua has power load requirements in excess of its own plant capacity, provided the reactor has then become a dependable source of steam.

The legislative history of section 111 (a) (1) of Public Law 85–162, as stated in the General Manager's letter, contains some indications of an intent that the rate to be charged for reactor steam should be the ascertained value of or the commercial rate at which comparable steam could be purchased from others. The value or commercial rate for interruptible steam is, we believe, somewhat similar to the value or commercial rate for interruptible or dump power. The General Manager's letter states it to be the Commission's conclusion that there is no commercial rate for interruptible steam. Based on our knowledge of rates charged for interruptible power, we believe this to be a correct statement. Most interruptible power is sold on the basis of negotiations between the parties, and the rate charged may depend more upon the bargaining positions of the respective parties than upon the cost of production or other normal factors. The legislative history also contains references to a fixed price for reactor steam. See, for example, the comments by Senator Anderson and Representative Holifield at pages 13682 and 12985 of the Congressional Record for August 9, 1957.

Because of the limited risks which cooperatives and publicly owned electric utilities can afford to assume in connection with power reactor demonstration projects, it seems unlikely that they would be willing to pay more for reactor steam to replace steam which could be produced in their own plants than the anticipated saving resulting from shutting down their own boilers. For the same reason, it appears improbable that they would agree to any greater fixed rate. Under such circumstances, the sale of steam at a flexible rate, as proposed, would avoid both the risk of loss and the possibility of a windfall to the contractor.

The enactment of section 111 (a) (1) of Public Law 85–162 demonstrates the intent of the Congress to permit participation in the second round by cooperative and publicly owned utilities. Having regard for the testimony to the effect that the Rural Electrification Administration would not approve participation by cooperatives which would expose them to financial risk, and in the interest of equality of treatment for publicly owned organizations, it is our opinion that arrangements for the sale of reactor steam on the basis proposed would not be contrary to the provisions of section 111 (a) (1).

However, in order to fulfill the purposes of the power reactor demonstration program, we believe it is important to provide for the maximum use of reactor steam, in order to secure the greatest possible operating experience. We note in the case of the proposed arrangement with RCPA and RCPA is obligated to utilize reactor steam to the fullest extent possible consistent with sound utilities

practice. If RCPA is to incur no loss by reason of its purchase of reactor steam, we believe it would be preferable to specify more definitely the conditions under which it may refuse to utilize such steam.

Sincerely yours,

JOSEPH CAMPBELL,
Comptroller General of the United States.

Representative HOLIFIELD. Do you believe your October 1960 date of completion is realistic, particularly in view of the delay that we have had on this negotiation, Mr. Davis?

Mr. DAVIS. We have been assured by the contractors that they believe they can meet this date.

Representative HOLIFIELD. Do you coincide with that from the standpoint of technical judgment?

Mr. DAVIS. I think it is possible. I would say that I might not be surprised that it might slip a few months or 2 or 3 months, but I think it is feasible for a plant of this size and one which is utilizing fairly well developed technology pretty much throughout.

Representative HOLIFIELD. What is the reason for the difference in the amount that was shown last year, the preconstruction research and development item of $2,760,000 compared with $321,000 in the current cost table. It is a startling difference.

Mr. MORRIS. This is a difference that resulted from the change in contractors. Our invitation which was issued following the withdrawal of A. M. & F. asked for proposals to design and construct a boiling water reactor plant of this size with thoria-urania fuel elements and gave the manufacturers the opportunity to include in this what development they felt was necessary.

Representative HOLIFIELD. In other words, it is really just a shift over into your increase in construction which amounts to $1,398,000.

Mr. MORRIS. I don't know that that can be said. We have a completely new deal here.

These figures are all based upon the proposal submitted by ACF Industries, which we have accepted, to do whatever development is necessary to design and build this reactor and furnish the core with thoria-urania fuel element at cost with a ceiling price.

Representative HOLIFIELD. It indicates that this line between research and development construction becomes a little bit hazy in these projects.

Mr. MORRIS. The arrangement with ACF is to cover all of these things and we have tried to split them up by these established categories we have been using.

The amount indicated by ACF for preconstruction research and development is only for development of these fuel elements. They are not assuming any new development work related to the design of the reactor itself.

Mr. DAVIS. This reactor will use components of a type that are pretty well worked out already.

Representative HOLIFIELD. Will the result give us any step forward in technology or will it just prove the operation of some of these components that have already been developed?

Mr. DAVIS. There are really two features of interest here. One of them is the utilization of the two cycles, in other words, the boiling water cycle and transferring heat to a second cycle which would appear to have possible advantages in the area of reactor control which

is one of the serious problems from the point of operation of the boiling water reactors.

So that even though you are combining fairly well-developed components you will get a new kind of operating system which will have different systems characteristics.

The other is the utilization of these uranium-thorium fuel elements which will seem to have possibility of high conversion ratio and long life.

The work here will cover necessity to provide fuel elements of this type for the reactor.

The operation of the reactor will be very useful in demonstrating this under operating conditions in a power reactor.

These, I think, are the two principal features and they do not relate to the development of a wholly new thing which is the kind of thing perhaps involved in the Piqua reactor and some of these others.

Representative HOLIFIELD. You think the technical results of this could only be attained by building a reactor of this size, that these results of your experiments up to date cannot be obtained in the laboratories much cheaper?

Mr. DAVIS. You will have to build a system that operates in this manner to find out how it behaves and a much smaller one would not be too practical. The fuel element problem again is one of getting high enough specific power so that you can give the fuel a high degree of radiation and a finite lifetime.

This requires a fairly powerful reactor to do this. It cannot be done conclusively in any way in a test reactor as such.

Representative HOLIFIELD. What is the equivalent price in mills per kilowatt-hour expected to be paid to AEC for steam for this plant?

Mr. MORRIS. Well, as in the Piqua case, the steam price is based upon initially, prior to the reactors demonstrating its dependability and prior to their load requiring this as a firm power component, the initial measure of the steam is the value of the fuel saved by shutting down a backup boiler.

Representative HOLIFIELD. In their area?

Mr. MORRIS. They will have a conventional boiler installed to service an alternate heat source to this particular turbine generator.

The measure of the steam price initially is the amount of fuel saved plus other identifiable savings in operation maintenance when this boiler can be shut down.

Representative HOLIFIELD. This is based on the cost in their particular area.

Mr. MORRIS. That is right, and in that area the fuel costs would be somewhere between 5 and 6 mills on the average.

Then in the later period, after the reactor has demonstrated its reliability and their system requires this as a firm power component, the steam price would include the fixed charge component that would apply to a conventional boiler.

Representative HOLIFIELD. What would be considered firm power? Would you have to operate it steadily in order to have it considered firm power or could you interrupt it for the insertion of new cores and that sort of thing without having to decrease your sale price of the steam?

Mr. MORRIS. You could interrupt it on a scheduled basis and you could perhaps tolerate some emergency, but essentially the difference is that the firm power would be available at the customer's option rather than at the seller's option.

In these cases you can't assure this will be true from the reactor until it actually demonstrates that it is as reliable as the boiler might be reliable.

Representative HOLIFIELD. Assuming you are in a position to furnish firm power you have no protection to the Government that they will ask for it on the basis of firm power?

Mr. MORRIS. Their load growth forecasts which are quite reliable, indicate that they will need this additional capacity somewhere around the middle of the 5-year period which we hope will coincide at least with the time the reactor has demonstrated its reliability.

Representative HOLIFIELD. Public Law 85–162 requires the Commission to dismantle the reactor after a maximum of 10 years of operation if the cooperative elects not to purchase it.

In view of that point, what was AEC's objective in obtaining an option to lease the site of the reactor for 30 years?

I hope that does not mean it will take 20 years to build it.

Mr. MORRIS. No. As I recall, this was offered to us in early negotiations. Not knowing just what the situation might be at the end of 5 years, or what statutes may be applicable, we did not change it.

I believe it is true under the present statute it is probably not possible to sustain any interest or activity there for that period of time.

Representative HOLIFIELD. You would not contemplate operating it that period of years from the standpoint of experimental development?

Mr. MORRIS. No, sir.

Representative HOLIFIELD. What part of this $9 million contract represents the fixed fee?

Mr. MORRIS. The fixed fee, I believe, is $629,000.

Representative HOLIFIELD. About 7 percent?

Mr. MORRIS. Yes. Of course, this is in our arrangement with ACF. You understand they are doing this on a ceiling price basis so they earn this fee only if they meet their estimates.

Representative HOLIFIELD. You have a superheater on this reactor, I see. Is that included in your cost here?

Mr. MORRIS. Yes, sir.

Representative HOLIFIELD. What is the estimated cost of that superheater and what technical advantage do you expect to gain by it?

Mr. MORRIS. I will see if I can find that cost.

Mr. DAVIS. The advantage of it is that you get steam at higher temperatures, although not at higher pressures. This does increase the thermodynamic efficiency of the cycle quite appreciably.

Representative HOLIFIELD. In terms of degrees, what do you estimate it will increase?

Mr. DAVIS. I believe it increases it from something like what you might expect without it, around 26 percent to, I believe, 31 percent.

Mr. MORRIS. That is $496,000 out of this for the superheater cost.

Representative HOLIFIELD. According to Mr. Davis, then, this would increase its temperature about a fourth or even possibly a third.

Mr. DAVIS. It would increase the overall efficiency by something like 5 percent. This means that for a given-size turbogenerator that you can get that much more power out of the steam.

Representative HOLIFIELD. Is this your first attempt to use a superheater in this type of reactor?

Mr. DAVIS. Well, the Northern States reactor will also have a superheater on it.

Representative HOLIFIELD. That is in the future, also.

Mr. DAVIS. That is in the future, also.

We don't have any reactors operating today which would utilize a superheater.

Representative HOLIFIELD. You tried, of course, the one on the *Sea Wolf*?

Mr. DAVIS. Yes, that did have a sodium-heated superheater.

Representative HOLIFIELD. Have you proved the principle of the superheater? A conventional superheater from fossil fuel.

Mr. DAVIS. This would be a conventional fossil fuel superheater.

Representative HOLIFIELD. You have not developed yet your superheater from the reactor?

Mr. DAVIS. No, sir; we are starting work now on nuclear-heated superheaters which we hope will be able to take the steam from the boiling-water reactor and directly superheat this steam by passing it through a reactor.

Representative HOLIFIELD. That is not contemplated in the Florida project; is it?

Mr. DAVIS. No, sir.

I should point out that any reactors that are gas cooled or that are liquid metal cooled you can utilize the high-temperature gas or liquid metals as was done in the *Sea Wolf* to superheat the steam once it is formed. This is somewhat different from the other idea we have in mind of taking the saturated steam from the reactor and passing it directly through a nuclear superheater.

Representative HOLIFIELD. Are there any further questions? Mr. Durham?

Chairman DURHAM. I have no questions.

Representative HOLIFIELD. Mr. Ramey.

Mr. RAMEY. Do you consider this $9 million ceiling price a reasonable price, or reasonable estimate of the job? In other words, that the job can be done for that cost?

Mr. DAVIS. I certainly would consider it a pretty reasonable estimate; yes.

Chairman DURHAM. You might recall on the previous contract, the previous proposal, the contractor withdrew with some indication that he had bought into the project. That would not be the case here?

Mr. DAVIS. That is not my impression of it; no, sir.

Representative HOLIFIELD. Excuse me, my understanding from your statement was that you had arrived at a satisfactory arrangement on the point brought up in the Comptroller General's letter.

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. And that agreement has now been submitted to him and approved?

Mr. DAVIS. No, sir.

Mr. MORRIS. No, sir.

Representative HOLIFIELD. You have not submitted it, but you feel you have complied with his suggestion?

Mr. MORRIS. We have followed his suggestions.

Mr. FIELDS. We referred to him this question on the Elk River and on the Piqua cases. We feel we have complied with his opinion there; yes, sir.

Representative HOLIFIELD. You have informed him as to the steps you have taken?

Mr. FIELDS. With respect to this sale of steam; yes, sir.

Representative HOLIFIELD. In both cases?

Mr. FIELDS. In both cases.

Mr. MORRIS. I believe you are referring, sir, to the suggestion at the end of his letter regarding the operating in accordance with sound utility practice.

Representative HOLIFIELD. Yes.

Mr. MORRIS. We have not had further contact with the Comptroller General, nor have we submitted anything to him. I don't believe we feel—I believe it is shown in there as a suggestion, or as a belief that something should be done, and we have now.

Representative HOLIFIELD. He said, and I will read this last paragraph:

> However, in order to fulfill the purposes of the power reactor demonstration program, we believe it is important to provide for the maximum use of reactor steam, in order to secure the greatest possible operating experience. We note in the case of the proposed arrangement with RCPA that RCPA is obligated to utilize reactor steam to the fullest extent possible "consistent with sound utilities practice."
>
> If RCPA is to incur no loss by reason of its purchase of reactor steam, we believe it would be preferable to specify more definitely the conditions under which it may refuse to utilize such steam.

Mr. MORRIS. And we have now done this as described in Mr. Davis' statement.

Mr. TOLL. Will this reactor use quite a bit of the technology from the EBWR reactor?

Mr. DAVIS. It will use the technology coming from all of the boiling-water reactors as well as the work that has been done on pressurized reactors. The fuel elements technology is mainly from the BORAX4 experimental work that Argonne has done on these urania-thoria fuels.

These have not so far been used on the EBWR reactor itself.

Mr. TOLL. Would Mr. Davis like to use this opportunity to inform the committee more of the details on the shutdown of the EBWR that was announced in the press release earlier this week?

Mr. DAVIS. I will be glad to say what I know about it. The fault here had nothing at all to do with the reactor being connected with the turbine. It was simply a blade that failed in one of the later stages of the steam turbine.

Apparently, a single blade simply cracked off at the base, was thrown out and took part of the shroud that goes around the blades with it.

This resulted, of course, in vibration of the turbine. The reactor and turbine were shut down. It was possible, I guess, the following day to go in and examine this.

The radiation level at the turbine was about two MR per hour. This was despite the fact that for about 2 weeks we had been conducting tests in the reactor itself of a purposely failed fuel element.

In other words, the operation prior to this accident had been one where we had taken a fuel element and drilled a hole in it and had been running it in the reactor to find out how much radioactivity was released from the fuel element and how much of this was carried over from the turbine.

So from the point of view of showing what can be done in the maintenance of a boiling water reactor it was a good thing, but at least it does give us some indication that they are able to take the turbine out and ship it directly to the factory and will replace the turbine blade there without any particular worry about contamination and will ship it back shortly and replace it in the turbine.

So in my mind this is a pretty convincing demonstration of the fact that a boiling water reactor is likely to be quite easy to maintain.

Representative HOLIFIELD. We sometimes learn from accidents; do we not?

Mr. DAVIS. We quite often learn more from the accidents than from the normal operation.

Representative HOLIFIELD. It is your intention, speaking now of the Commission's intentions, to proceed expeditiously with this if it is approved?

Mr. DAVIS. Yes, sir.

Representative HOLIFIELD. Are there any further questions from the staff?

Would the people from the Elk River area, if they are in the room, care to say anything at this time?

STATEMENT OF O. N. GRAVGAARD, PRESIDENT, RURAL COOPERATIVE POWER ASSOCIATION, OF ELK RIVER, MINN.

Mr. GRAVGAARD. Mr. Chairman, could I add just one comment?

My name is Gravgaard, president of Rural Cooperative Power.

I would like to say a word in defense of the Atomic Energy Commissioners. I think they have been about the toughest group to deal with that I have ever experienced.

Now, whether or not they have driven a good bargain I don't know; I think. They have been really tough.

We have had 3 years of negotiations, in Schenectady, in New York, in Chicago, here in Washington. It seems to me it has been most tedious.

It is a little different from farming out there in Minnesota. When I go out to do a job I go out and do it. I just finished my soybean planting yesterday. I don't know whether this should go on the record, or not. I am just talking.

Representative HOLIFIELD. I think it is all right. I think it is pretty good for the record.

Mr. GRAVGAARD. I would like to say this, that we in Rural Power started out from scratch, out of necessity. Power was not available several years ago. We started from scratch. We operated in the red for some time.

Now we are up in the black and we are honest people in Minnesota, and I think they are everywhere, we don't want to lean on Government too much.

I don't believe in that. I like to hold my head high and be on my own as much as possible.

Of course, we know that we are not able to build an atomic energy reactor in Minnesota.

Representative HOLIFIELD. This committee knew that last year, too.

Mr. GRAVGAARD. I am sure you did. Our people are not people of wealth. We represent the farming area and most of them don't have too much money.

Let me say this in conclusion: We in Rural Power will do everything to make this reactor a financial success. We are part of our Government; we want to work with it, not against it.

Thank you.

Representative HOLIFIELD. You are certainly welcome. We hope that this will be a mutually satisfactory arrangement.

This committee was much concerned with some of these cooperative programs because we felt that you people in the cooperatives might be falling into a trap by accepting unknown financial risks in this field which we still look upon as being an experimental research and development field.

We believe that under the guidance that the committee gave to these projects that you have a chance now to get the experience and the Government has a chance to get the research and development and make it available to all the people of America without penalizing any one small group such as your group in Minnesota.

I might say for the record that your Senators and your Representatives have contacted most of the members, I am sure, of this committee, I know they have contacted me in regard to this, and they have all expressed their hope that this could be consummated and built up in your State of Minnesota.

Are there any further questions or testimony? If not, the committee stands adjourned.

(Subsequent to the hearing, on May 28, 1958, the Joint Committee adopted the following resolution:)

RESOLUTION

Whereas Section 111b of Public Law 162, 85th Congress, provides that before the Commission enters into any arrangement the basis of which has not been previously submitted to the Joint Committee on Atomic Energy and which involves appropriations authorized by subsection (a) of section 111, the basis for the arrangement which the Commission proposes to execute shall be submitted to the Joint Committee, and a period of 45 days shall elapse while Congress is in session: *Provided, however,* That the Joint Committee, after having received the basis for a proposed arrangement, may by resolution in writing waive the conditions of or all or any portion of such 45-day period; and

Whereas the Commission on April 30, 1958, submitted to the Joint Committee the bases of proposed arrangements 58–111–7 with city of Piqua, Ohio, and North American Aviation, Inc., and 58–111–8 with Rural Cooperative Power Association, Elk River, Minn., and ACF Industries, Inc., and the Commission requested waiver of said 45-day period; and

Whereas the Commission on May 16, 1958, submitted to the Joint Committee the basis of proposed arrangement 58–111–9 with Carolinas Virginia Nuclear Power Associates; and

Whereas the Subcommittee on Legislation of the Joint Committee held a public hearing on May 23, 1958, and received testimony concerning the bases of the three proposed arrangements; and

Whereas the Subcommittee on Legislation and the full Joint Committee considered the bases of the three proposed arrangements at meetings on May 28, 1958: Now, therefore, be it

***Resolved*, That, pursuant to section 111b of Public Law 162, 85th Congress, the Joint Committee hereby waives requirements of the 45-day period for said proposed arrangements 58–111–7, 58–111–8, and 58–111–9.**

Dated this 28th day of May 1958.

(Thereupon, at 11:50 a. m., Friday, May 23, 1958, the subcommittee was adjourned, to reconvene subject to the call of the Chair.)